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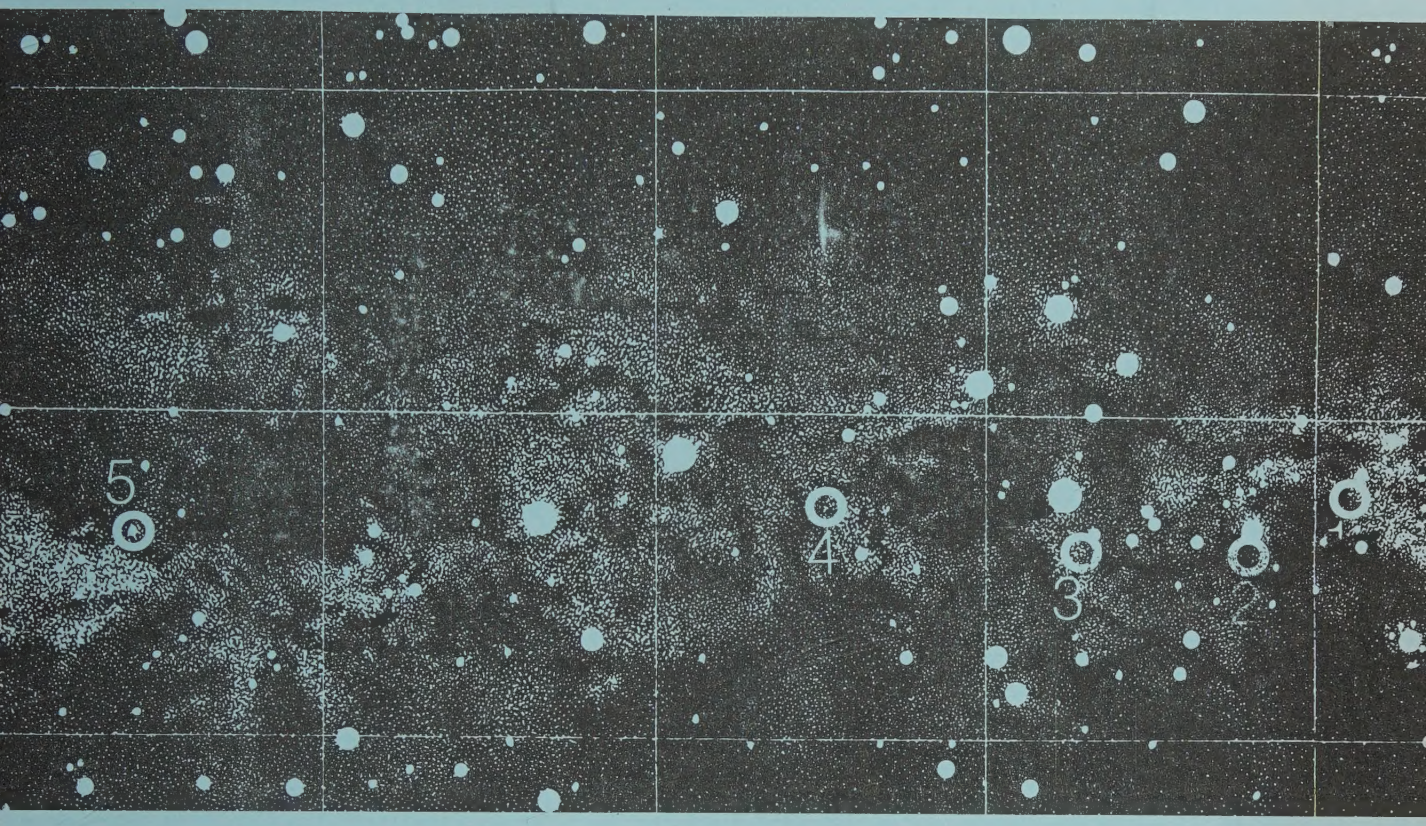

A CONTRIBUTION TO THE STUDY OF THE GALACTIC STRUCTURE IN CARINA, CRUX, CENTAURUS AND NORMA

BY

KJELL L. V. JOHANSSON

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Abstract: Five fields with diameters ranging from 0.5 to 1.0 degrees and situated close to the galactic equator in the galactic longitude interval 290 to 330 degrees have been investigated with respect to interstellar reddening, stellar distribution and galactic clusters. In total 1087 stars have been observed photoelectrically in UBV (down to a magnitude of 13 in B) and classified on objective prism plates (77%) or in the two-colour diagram (23%), and their individual spectrophotometric distances have been determined and used in the analysis.

Most of the reddening occurs within 0.8 kpc from the Sun, with a colour excess of 0.3 magnitudes in B-V. In two of the fields (in Carina and Crux) there is no additional reddening out to 4 kpc.

The observed distribution of the stars with respect to the true distance modulus differs significantly from the one obtained from randomly distributed stars. This is probably caused by the presence of clusters and by the Carina spiral arm.

The numbers of early type stars decrease with the galactic longitude in the interval studied, with no OB stars in Norma, where on the other hand the richness in A-F stars is outstanding.

Eight clusters have been investigated, one of them earlier unknown (in Norma), and their mean colour excesses, distances, earliest spectral types and other parameters have been determined.

Key words: galactic structure; interstellar reddening; stellar distribution; galactic clusters.

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SUMMARY

Five fields with diameters ranging from $0^{\circ}.5$ to $1^{\circ}.0$ and situated close to the galactic equator in the longitude interval $l=290^{\circ}$ to $l=330^{\circ}$ have been investigated with respect to stellar distribution, interstellar reddening and galactic clusters or associations. Each field has been divided into two regions by concentric circles. Inside the inner circle, stars down to about $B=13^{m}$ have been classified on objective prism plates and photoelectrically observed in UBV. The corresponding magnitude limit for the annuli is $11^{m}.5$. For about 23 percent of the stars the spectral type has been estimated in the two-colour diagram. Practically all stars with $U-B>0^{m}.70$ have been treated as giants. Some of the stars of earlier type and having unreasonably high reddening if treated as nearby main sequence stars, have also been classified giants. In total 1087 stars have been observed.

The individual spectrophotometric distances of the stars have been determined and the colour excesses have been examined as a function of distance in the various regions. It seems that the reddening is negligable out to a distance of about 100 pc. Then, most of the reddening occurs within about 0.8 kpc from the Sun, where a value of $E_{B-V}=0^{m}.30-0^{m}.35$ is reached. In the interval 0.8-4.0 kpc there is almost no additional reddening in fields 2 and 3, while in field 1 it increases in an irregular manner all the way out to at least 4 kpc. The reddening in field 4 seems constant in the interval 0.8-2.0 kpc, but may increase further out. In field 5 the reddening increases steadily out to at least 1.5 kpc, where $E_{B-V}=0^{m}.45$.

The luminosity function given by van Rhijn has been used to distribute fictitious stars in a "random" manner. The resulting expected numbers of stars in various luminosity groups are less than the observed ones by a factor of 4 for some of the luminosity groups. Such differences are probably mainly caused by local variations in the stellar distribution. The distribution of the stars according to true distance moduli has been compared with the one obtained for the randomly distributed stars. There is a rather pronounced disagreement, probably caused by the presence of clusters and by the Carina spiral arm.

For the established or suspected clusters, various parameters -as for example mean colour excess, distance and earliest spectral type - have been determined.

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1. INTRODUCTION

1.1 The background of the project

In 1956 Professor B. Lindblad at the Stockholm Observatory initiated a project called: "The Stockholm Observatory Southern Milky Way Survey". During the years following, a great number of objective prism plates were secured with the ADH Baker-Schmidt telescope at the Harvard-Boyden Observatory in Bloemfontein, South Africa. The plates cover in a saw-tooth pattern a zone having a width of about six degrees along the galactic equator, from $l=237^{\circ}$ to $l=7^{\circ}$. In addition, direct photographic plates of the same region have been taken in blue and yellow with the Metcalf 25 cm astrograph. More information on the Survey may be found in Lodén (1968).

When inspecting the objective prism plates (240 $Åmm^{-1}$) Lodén (1973a) found that very frequently stars with small angular separation had "coinciding" spectral type and apparent magnitude. In his paper he discusses a number of possible explanations of the phenomenon, and the reader is referred to it for details. We list here some of his suggestions:

a) projection effect,
b) temporary encounter,
c) members of a small cluster,
d) multiple system,
e) spurious phenomenon.

There is probably no unique explanation of the phenomenon. However, the alternatives c and d are the more interesting ones, when considering problems connected with stellar formation. It is generally agreed that most stars form in groups that gradually disintegrate. Thus, there may exist several clusters or "mini-clusters" in the galactic plane, awaiting detection. Lodén (1973b) gives a list of possible clusters in the Southern Milky Way.

1.2 The aim of the project

The main purpose of the project is to study

1) the colour excess,
2) the stellar distribution,
3) the earlier known or suspected clusters.

1) The colour excess will be examined for various distance intervals in the selected parts of the Southern Milky Way.

2) The stellar distribution will be studied for various distance intervals in the different fields. The resulting, observed distribution, will then be compared with what one may expect from randomly distributed stars. If there is a difference that is significant, this may be a result of the presence of clusters in the fields. In the procedure of generating randomly distributed fictitious stars, the luminosity function given by van Rhijn (1936) will be used. We will also try a luminosity function that is obtained by modifying the van Rhijn luminosity function. The procedure is described in chapter 4 (see also Appendix A and B).

3) The presence of known clusters in some of the fields will serve to test the possibility of finding various types of clusterings by studying the distribution of the stars with respect to their true distance moduli. They ought to be easily recognized in the material. Otherwise there is little hope of finding local fine structure or loose clusterings, and it will not be possible to confirm or reject the cluster candidates given by Lodén (1973b) by this method. For the established clusters and the Lodén cluster candidates, and the other suspected clusters, the distance, mean colour excess, earliest spectral type and other parameters will be determined.

2. THE MATERIAL

From a list of fields with interesting cluster candidates (Lodén, private communication) five fields were selected. The fields are situated between the galactic longitudes $l=290^{\circ}$ and $l=330^{\circ}$. They include his cluster candidates nos. 421, 422, 615, 807 (Lodén 1973b) and 822, 823, 824 (Lodén 1971). Each field has been divided into two regions by concentric circles (cf. the identification charts, p. 100) and all stars brighter than about $B=13^{m}.0$ were observed in the inner region. The corresponding magnitude limit for the annuli is about $11^{m}.5$. The magnitude limits were originally estimated ($\pm 0^{m}.5$) by means of the Metcalf astrograph "blue" plates.

All the stars, in total 1087, have been observed photoelectrically in UBV, and some of them, 49, also in uvby and Hβ. The Boyden ADH spectral plates, already mentioned, have been used for estimating spectral type for as many stars as possible visually. Due to a considerable overlap frequency on the plates, and in some cases to underexposure, only 832 stars could be classified directly on the plates. For the remaining 255 stars their positions in the two-colour diagram were utilized. Relevant information about the fields investigated is given in Table 1.

Table 1. The fields investigated. B_L is the faintest magnitude observed (limiting magnitude) and B_C is the B-magnitude down to which the material is regarded as complete. (s.r.=small region and l.r.=large region.)

Field		Diameter	B_L	B_C	Coordinates of centre R.A.(1950)	Decl.	l	b	Number of stars observed: UBV	uvbyβ	sp.plates
1	s.r.	19!0	$14^{m}.3$	$12^{m}.2$	$11^{h}09^{m}.2$	$-60^{\circ}23'$	$291^{\circ}.0$	$-0^{\circ}.1$	341	21	235
	l.r.	34.7	13.9	11.3							
2	s.r.	23.7	14.1	12.7	11 30.3	-63 06	294.2	-1.8	197	5	152
	l.r.	42.9	14.0	11.4							
3	s.r.	28.2	13.6	12.3	12 17.8	-64 30	299.6	-2.1	170	8	158
	l.r.	51.5	12.8	11.8							
4	s.r.	28.5	13.9	12.4	13 23.8	-62 03	307.1	+0.3	210	7	161
	l.r.	51.6	13.1	11.5							
5	s.r.	28.7	14.4	12.9	15 42.4	-52 15	327.9	+1.8	169	8	126
	l.r.	52.4	13.5	11.5							

2.1 The photoelectric observations and reductions

The photoelectric observations were performed at the European Southern Observatory on La Silla in Chile during two periods, the first one in March, 1975, the second one in July, 1976. For the UBV observations the ESO 50 cm telescope was used; in 1975 with the photometer in the gain step mode, and in 1976 in the pulse counting mode. The observations in uvby and Hβ were performed with the Danish 50 cm telescope in 1975 and with the ESO 50 cm telescope in 1976, both years in the pulse counting mode. The Danish photometers used are briefly described by Grönbech et al. (1976) and by Grönbech and Olsen (1977).

At the ESO 50 cm telescope a diaphragm of 20" was used, and the integration time was typically around 30 seconds (all filters). As a matter of fact, the integrations were continued until the mean error as displayed on the handpaddle was below 1 %. However, for faint stars, and especially the red ones, the integration was interrupted after about two minutes in U and one minute at the other filters, giving a mean error of about 5 %.

When observing adjacent programme stars, the sky measurements were not always repeated for relatively bright stars. However, if the moon was up, or if the star was faint, especially in U (red stars), the sky (s) was measured after each star (⋆): $B_{\star}V_{\star}U_{\star}U_{s}V_{s}B_{s}$. For very red and faint stars the order of measurements was $B_{\star}V_{\star}U_{\star}U_{s}U_{\star}V_{s}U_{\star}U_{s}V_{s}B_{s}$. Sky measurements were always performed close to the programme star or group of programme stars, since the background may vary considerably from place to place in galactic regions.

In uvby and Hβ the order of measurements was $y_{\star}b_{\star}v_{\star}u_{\star}\beta w_{\star}\beta n_{\star}\beta n_{s}\beta w_{s}u_{s}v_{s}b_{s}y_{s}$ at the ESO telescope, while the Danish photometers allowed simultaneous observations at the different filters used. At the Danish telescope the integration time was mostly one minute, and a diaphragm of 15", or in cases of poor seeing 30", was used.

The airmass was in almost all cases less than 2.0, and never exceeded 2.4 for the programme stars.

The standard stars used for UBV photometry are E-region standards, most of them selected from a list given by the ESO-staff (Garnier 1975, unpublished), but three are from an older catalogue given by Cousins and Stoy (1963)

(HD 80817, HD 82152 and HD 130035). Five of the Johnson and Morgan standards (1953) were observed once in 1975 for checking purposes (HD 46106, HD 46149, HD 46150, HD 46202 and HD 46223). Accordingly, they were only treated as programme stars. In addition, some highly reddened OB-stars (Hiltner 1956) were observed, so that a possible reddening influence on the reductions could be checked. In 1975 they were treated as programme stars, but in 1976 a couple of Hiltner stars also served as standards (see Table 2). For 19 E-region standards a comparison with Cousins (1973) has been made, and the result is shown in Figures 1 and 2. From them it is quite evident that the values given by Cousins are more homogeneous than those appearing in the ESO-list. The magnitudes and colours of the standard stars are presented in Table 2.

In Figure 3 the differences in V, B-V and U-B (Johansson-Hiltner) of the Hiltner stars are plotted versus $3E_{B-V}$ (as given by Hiltner). From this figure we conclude that the reductions are independent of the amount of reddening, at least for stars with $E_{B-V}<1^m.0$. For higher reddening we have too few objects to draw any conclusion in this respect. It also appears from Figure 3 that two of the observed Hiltner stars (HD 164492 and HD 316332) show deviations greater than expected from the errors in the observations. They might possibly be variable.

For UBV standards used both in 1975 and 1976, the magnitudes and colours as obtained from the reduction programmes have been compared. All eight stars together give the following mean values of the differences (1975-1976):

V	B-V	U-B
$+0^m.005$	$-0^m.003$	$-0^m.016$
±0.001	±0.001	±0.009

where the measure of dispersion is the standard deviation (s.d.) defined as:

$$\text{s.d.}=\left(\sum_{i=1}^{N}(x_i-\bar{x})^2/(N-1)\right)^{1/2} \qquad (1)$$

Excluding the stars HD 156236 and HD 157477 which were only observed once in 1975, we get $-0^m.004$ $\pm 0^m.004$ in U-B. We therefore conclude that the zero-points of the observational periods do not differ significantly.

The standard stars used for uvby and Hβ photometry are given in Table 3. The sources of b-y, m_1, c_1 and β are given in the notes to the table. A comparison of the stars used as standards (9 in uvby and 8 in Hβ) during

both observational periods give the following mean values and corresponding standard deviations of the differences (1975-1976):

V	b-y	m_1	c_1	β
$+0^m.004$	$+0^m.002$	$+0^m.004$	$-0^m.005$	$+0^m.005$
±0.005	±0.001	±0.002	±0.003	±0.003

Also here the zero-points are essentially the same for both periods.

The reductions of the material obtained with the Danish telescope were made as described by Crawford and Barnes (1970). In these reductions a dead time constant of 65 ns (as given in the manual of the telescope) was used. All observations performed with the ESO 50 cm telescope were reduced at ESO in Chile, utilizing the reduction programmes available there. For the observations made in 1975, a calibration of the gain factors of the amplifier has been done by two independent methods. Firstly, a number of stars (16) has been observed at different gain steps, some of the stars almost each night. Secondly, a calibration has been carried out by means of a Keithley 261 Picoampere Source (at six occasions after the observations). From these calibrations no temperature dependence could be found, and the agreement between the two methods is excellent for the gain steps used in the observations, the differences being at the most $0^m.004$. In the reductions a mean value of these calibrations was used.

For the observations performed in 1976, the dead time constant was determined in order to check the value of 60 ns given by the ESO-staff. For this purpose three bright A0 stars (ι Ps A, HR 8381 and HD 213155) were observed through a neutral filter, Strömgren y and Johnson B and V. By combining these stars in various manners as measured at different filters, keeping an approximate magnitude difference of 2^m, a number of individual dead time constants (t) could be calculated using the formula

$$t = (a_2b_1 - a_1b_2)/(a_2b_1(a_1+b_2) - a_1b_2(a_2+b_1)) \qquad (2)$$

where a_1,a_2; b_1,b_2 are the observed numbers of counts per second for stars A and B at filter 1 and 2, respectively. Formula (2) may easily be derived from $a_1/a_2=b_1/b_2$ and $x_T=x/(1-xt)$, where x_T is the true number of incoming photons, while x is the observed number of photons per second. From 12 independent determinations the resulting mean value and corresponding mean error is 61±3 ns, so there was no reason to change the value of 60 ns.

Table 2. Standard stars used in UBV. Spectral types are from the HD Catalogue except for the Hiltner stars (H). (N is the number of observations and 'ext' stands for extinction standard.)

HD	R.A. (1950)	Decl.	V	B-V	U-B	V	B-V	U-B	N	Sp	Notes
			Standard Catalogue values			Present values					
7795	$1^h14.^m8$	$-42^\circ48'$	7.86	- .10	- .37	7.86	- .08	- .39	8	B9	1976
8024	1 16.7	-46 25	9.10	.44	- .06	9.11	.44	- .00	8	F8	1976
8049	1 17.0	-43 53	8.69	.88	.51	8.69	.88	.45	4	G5	1976
8305	1 19.3	-45 24	7.44	.38	- .02	7.45	.36	- .00	3	F0	1976
8382	1 20.1	-46 29	8.43	.22	.08	8.44	.21	.11	3	A2	1976
8963	1 25.4	-46 06	6.96	1.49	1.82	6.96	1.51	1.82	3	K0	1976
8977	1 25.5	-46 24	7.70	.09	.09	7.70	.09	.08	2	A0	1976
78429	9 04.8	-43 18	7.31	.66	.17	7.30	.67	.20	2	G2	1975
80777	9 18.3	-44 58	6.69	1.23	1.32	6.69	1.23	1.32	33	K0	1975, ext
80817	9 18.7	-44 04	8.02	.09	.09	8.02	.09	.08	19	A2	1975
81276	9 21.4	-44 45	7.93	.06	.08	7.93	.05	.05	20	A0	1975
82121	9 26.8	-45 16	7.62	- .15	- .63	7.61	- .12	- .63	53	B8	1975, ext
82152	9 27.0	-43 35	8.10	.50	.01	8.10	.48	+ .00	19	F8	1975
103481	11 52.3	-43 20	7.43	1.28	1.30	7.43	1.28	1.31	64	K0	1975, ext
105283	12 04.8	-42 58	7.20	.42	- .02	7.20	.42	.01	11	F2	1975
105498	12 06.2	-44 39	8.05	- .02	- .22	8.06	- .04	- .24	11	A0	1975
106902	12 15.1	-45 07	7.96	- .09	- .57	7.96	- .09	- .56	67	B9	1975, ext
128413	14 34.9	-45 40	6.82	1.18	1.21	6.82	1.18	1.20	95	K0	1975, 1976, ext
128726	14 36.7	-45 32	8.06	.02	- .10	8.06	.02	- .06	8	A0	1975
129747	14 42.5	-45 40	8.48	.69	.15	8.48	.68	.17	16	G0	1975, 1976
130035	14 44.1	-44 15	9.36	.37	.07	9.36	.39	.07	19	F0	1975
130119	14 44.5	-45 47	8.08	- .01	- .24	8.08	- .03	- .25	93	B9	1975, 1976, ext
130761	14 48.2	-46 53	8.00	.44	- .04	7.99	.44	- .02	10	F2	1976
130998	14 49.4	-46 49	8.18	.06	.04	8.18	.05	.06	27	A0	1975, 1976
131627	14 52.9	-43 53	7.88	.16	.12	7.88	.16	.12	9	A2	1976
147889	16 22.4	-24 21	7.92	.86	- .15	7.89	.85	- .15	2	B2V	1976, H 643
156236	17 15.0	-46 46	7.21	.62	.41	7.20	.63	.59	12	F2	1975, 1976
156623	17 17.2	-45 22	7.25	.09	.08	7.24	.10	.05	8	A0	1976
157316	17 21.1	-44 58	6.66	.38	- .01	6.64	.40	- .04	1	F0	1975
157477	17 22.0	-45 14	8.08	.26	.17	8.09	.25	.20	10	A3	1975, 1976
157624	17 22.9	-44 36	7.87	- .03	- .58	7.86	- .04	- .57	48	B8	1975, 1976, ext
159868	17 35.4	-43 07	7.23	.72	.22	7.23	.72	.26	47	G5	1975, 1976, ext
316332	17 44.3	-29 37	9.47	1.38	.31	9.49	1.35	.32	2	B3Ia	1976, H 659
164438	17 58.9	-19 06	7.48	.34	- .66	7.45	.33	- .64	2	O9IV	1976, H 697
164492	17 59.4	-23 01	7.63	- .00	- .86	7.54	- .01	- .87	1	O7	1976, H 698
168112	18 15.9	-12 07	8.52	.69	- .40	8.50	.69	- .38	2	O6	1976, H 744
188246	19 52.6	-44 08	7.17	- .09	- .19	7.17	- .07	- .22	11	A0	1976
189247	19 57.4	-44 07	7.65	.44	- .03	7.64	.44	- .01	4	F2	1976
190057	20 01.6	-46 15	6.95	1.50	1.86	6.95	1.52	1.83	4	K0	1976
192758	20 14.9	-43 02	7.02	.32	- .02	7.01	.33	.02	4	F0	1976
192826	20 15.2	-42 47	7.46	.59	.14	7.43	.59	.17	2	G0	1976
192844	20 15.4	-44 42	7.55	.95	.61	7.54	.96	.63	2	K0	1976
213155	22 27.3	-42 33	6.91	- .09	- .06	6.92	- .04	- .10	15	A0	1976
214728	22 38.0	-44 45	8.88	.30	.03	8.89	.30	.05	7	F0	1976
216009	22 47.0	-44 41	8.05	.06	.04	8.06	.05	.08	8	A0	1976
216291	22 49.5	-46 15	7.24	1.46	1.71	7.24	1.46	1.74	5	K0	1976
216531	22 51.4	-46 09	8.29	.60	.02	8.30	.58	.03	4	G0	1976
216679	22 52.6	-46 36	7.52	.39	- .02	7.53	.38	.04	2	F2	1976
216743	22 53.1	-42 49	7.25	.16	.06	7.26	.16	.08	4	A2	1976

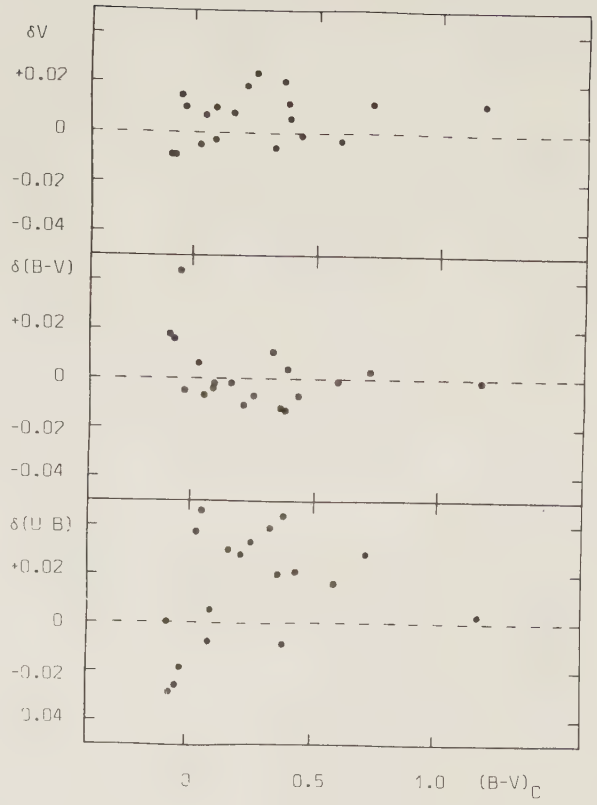


Fig. 1. E-region standards. The differences: Cousins - ESO-list are given as a function of $(B-V)_C$ (C=Cousins).

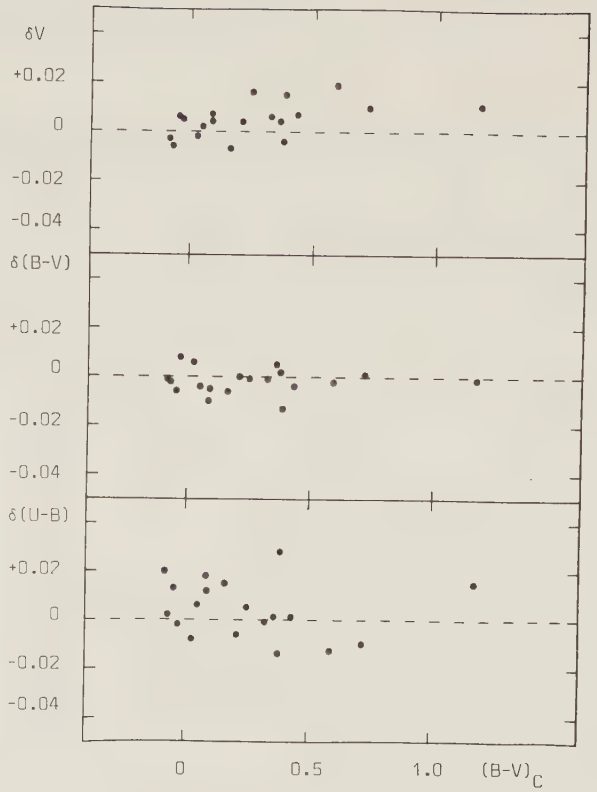


Fig. 2. E-region standards. The differences: Cousins-Johansson are given as a function of $(B-V)_C$ (C=Cousins).

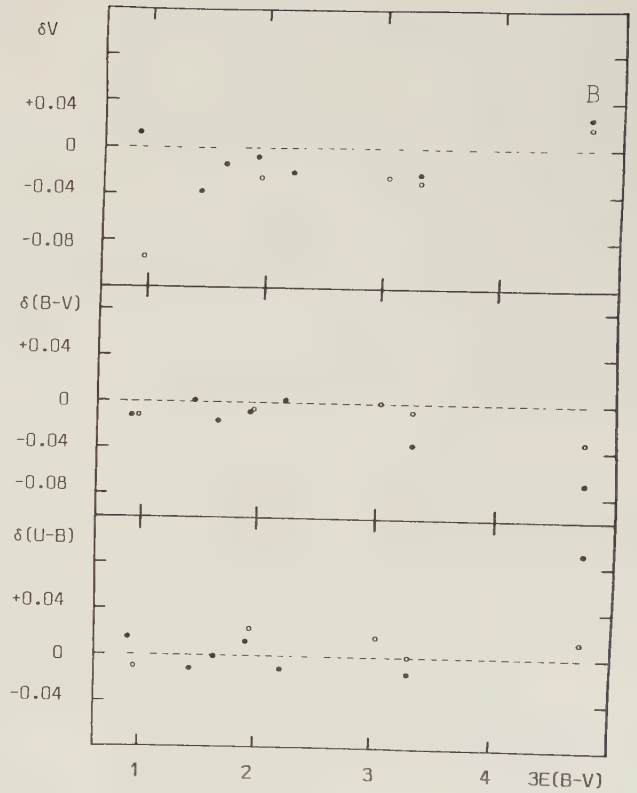


Fig. 3. Hiltner stars. The differences: Johansson-Hiltner are given as a function of 3E(B-V) (as given by Hiltner). Open circles represent observations performed in 1976. (A=HD 164492 and B=HD 316332.)

Table 3. The standard stars used in uvby and Hβ. V magnitudes and spectral types are from the Bright Star Catalogue (1964). (N is the number of observations, 'ext' stands for extinction standard.)

HR	V	b-y	m_1	c_1	β	V	b-y	m_1	c_1	β	N		Sp	Notes on	
	Standard Catalogue values					Present values					uvby	β		uvby	β
1134	4.99	-.061	.096	.421	2.667	---	---	---	---	2.654	0	1	B5	B --	B 1975
2056	4.86	-.072	.113	.419	2.717	4.93	-.076	.117	.428	2.715	1	2	B5V	A 1975	B 1975
2106	4.35	-.075	.092	.367	2.645	4.37	-.077	.094	.367	2.643	1	2	B3IV	A 1975	B 1975
2233	5.64	.320	.154	.447	---	5.59	.317	.156	.449	2.658	1	1	F6V	A 1975	- 1975
2244	5.00	-.022	.114	.885	2.747	4.96	-.033	.108	.884	2.746	1	1	B8V	B 1975	B 1975
2657	4.10	-.048	.097	.561	2.689	4.12	-.048	.098	.560	2.686	4	2	B8II	A 1975	B 1975
2812	4.95	.018	.072	.642	2.699	---	---	---	---	2.700	0	1	B7	B --	B 1975
2961	4.84	-.086	.102	.308	2.662	4.88	-.084	.099	.311	2.674	2	2	B3n	A 1975	B 1975
3084	4.49	-.085	.102	.248	2.664	4.50	-.089	.107	.250	2.660	2	1	B3V	A 1975	B 1975
3131	4.62	.047	.160	1.127	2.834	4.64	.047	.149	1.138	---	3	0	A3V	A 1975	B --
3314	3.90	-.008	.155	1.030	2.897	3.92	-.006	.148	1.027	2.897	3	2	A0V	A 1975	C 1975
3410	4.14	.008	.149	1.097	2.851	4.19	-.009	.163	1.092	---	1	0	A0V	A 1975	C --
3454	4.30	-.088	.093	.247	2.653	4.34	-.097	.111	.254	---	1	0	B3V	A 1975	C --
3849	5.06	-.071	.109	.413	2.700	5.08	-.074	.110	.419	2.702	3	2	B5V	A 1975	B 1975
3856	4.51	-.035	.138	.827	2.835	4.48	-.033	.135	.820	2.832	2	2	B9V	A 1975	B 1975
4119	5.04	-.065	.115	.485	2.730	5.09	-.059	.115	.485	2.728	1	2	B6V	A 1975	C 1975
4133	3.85	-.031	.041	-.037	2.555	3.88	-.024	.046	-.037	2.553	1	1	B1Ib	A 1975	C 1975
4293	4.38	.057	.178	1.121	2.867	4.36	.055	.175	1.116	2.867	2	1	A2IV	A 1975	B 1975
4343	4.46	.010	.162	1.196	2.864	4.46	.014	.153	1.191	2.874	1	1	A2IV	A 1975	B 1975
4405	4.06	.117	.196	.897	2.821	4.09	.112	.195	.900	---	1	0	A7IV	A 1975	B --
4441	5.07	.666	.265	1.100	2.637	5.02	.628	.319	.974	2.663	2	2	G0Ia	B 1976	B 1976
4522	4.10	.549	.324	.403	2.576	4.11	.547	.323	.423	2.604	2	2	G3III	B 1976	B 1976
4540	3.61	.352	.187	.415	2.628	3.62	.349	.180	.433	---	1	0	F8V	A 1975	C --
4775	4.30	.244	.167	.544	2.699	4.31	.242	.161	.556	---	2	0	F0IV	A 1975	B --
4802	3.86	.025	.158	1.090	2.861	3.86	.027	.145	1.094	2.872	5	4	A2V	A 1975-76	B 1975-76
4889	4.26	.124	.185	.974	2.811	4.26	.126	.171	.982	2.822	4	3	A7III	A 1975-76	B 1975-76
5168	4.22	.246	.164	.549	2.699	4.23	.248	.153	.564	2.709	5	4	F2III	A 1975-76	B 1975-76
5260	4.34	.379	.207	.721	2.647	4.34	.372	.220	.715	2.648	14	23	F7I-II	B 1975-76 ext	B 1975-76
5270	6.20	.634	.088	.551	2.540	6.18	.642	.086	.532	2.563	1	1	G0VI	A 1976	C 1976
5285	4.35	-.096	.102	.166	2.655	4.35	-.098	.098	.179	2.651	14	24	B3V	A 1975-76 ext	B 1975-76
5303	4.90	.129	.215	.807	2.811	4.83	.125	.229	.777	---	1	0	A2p	B 1975	B --
5358	4.32	.129	.018	.482	2.626	4.33	.136	.017	.473	2.612	13	22	B5II	B 1975-76 ext	B 1975-76
5626	4.05	-.079	.104	.269	2.686	4.03	-.082	.113	.266	2.687	1	1	B3V	A 1975	B 1975
5660	4.90	.245	.130	1.370	2.744	4.90	.249	.123	1.372	2.740	4	2	F0I	A 1975-76	B 1976
5993	3.95	.038	.041	.005	2.621	3.94	.031	.047	.013	2.619	4	3	B1V	A 1975-76	B 1976
5997	4.31	.518	.290	.444	2.579	4.31	.525	.269	.466	2.593	2	3	gG2	A 1976	B 1976
6027	4.00	.080	.048	.140	2.671	4.00	.083	.054	.145	2.664	1	2	B2IV-V	A 1975	B 1975
6141	4.78	-.048	.089	.197	2.662	4.78	-.049	.086	.204	2.659	4	6	B2V	A 1975-76	B 1975-76
6272	5.79	.146	.078	-.142	2.406	5.78	.143	.088	-.159	2.423	2	2	O8fp	D 1976	D 1976
6672	6.20	.097	.017	-.124	2.565	6.18	.090	.023	-.133	2.558	1	1	O8	D 1976	D 1976
6743	3.66	.006	.034	.009	2.583	3.66	-.003	.044	.025	2.567	2	2	B0.5II	A 1976	B 1976
7446	4.96	.084	-.029	-.030	2.565	4.94	.082	-.016	-.032	2.572	1	3	B0.5III	A 1976	C 1975-76
7773	4.75	-.022	.134	1.015	2.856	4.75	-.022	.118	1.026	2.845	1	1	B9V	A 1976	B 1976
8181	4.22	.334	.117	.315	2.611	4.23	.330	.118	.328	2.627	1	1	F8V	A 1976	B 1976
8848	3.98	.271	.141	.565	2.671	4.00	.269	.135	.580	2.680	3	3	F0III	A 1976	B 1976
9076	4.48	-.024	.096	.885	2.718	4.52	-.031	.092	.900	2.717	2	2	B7V	A 1976	B 1976

Key to the notes:

A = Grönbech et al. (1976)
B = Crawford et al. (1970)
C = Crawford and Mander (1966)
D = Crawford (1975a)

2.2 Spectral classification and luminosity determination

Most of the stars (77%) were classified on objective prism plates taken with the ADH Baker-Schmidt telescope. The remainder of the stars (23%) were classified in the two-colour diagram (cf. below). For each field there were several plates with different exposure times (cf. Table 4). Only a few stars in field 5 were outside the ADH plates, and for this field it was necessary to secure further spectral plates. This was kindly done by A. Kinnander during spring 1977, using the Uppsala Southern Schmidt telescope at Mount Stromlo, Australia. The objective prism plates used for spectral classification are listed in Table 4, where also the reciprocal dispersions are given.

Table 4. The spectral plates used. Here ADH stands for the Armagh Dunsingk Harvard Baker-Schmidt telescope, while USS means the Uppsala Southern Schmidt telescope.

Field	Telescope Plate No.	Date	S.T.	Exposure time	Emulsion	Dispersion at Hγ
1	ADH 4450	1958-03-17	12^h28^m	10×90^s	IIa-O	240 Åmm^{-1}
1	ADH 4458	1958-03-21	10 48	8×30^m	IIa-O	240
1	ADH 4478	1958-03-26	11 13	48	IIa-O	240
1	ADH 5546	1959-06-08	11 50	4	IIa-O	240
2	ADH 5369	1959-04-12	11 40	48	IIa-O	240
2	ADH 5547	1959-06-08	12 04	12	IIa-O	240
2	ADH 5548	1959-06-08	12 19	5	IIa-O	240
3	ADH 4754	1958-06-24	12 29	12	IIa-O	240
3	ADH 4755	1958-06-24	12 45	4	IIa-O	240
3	ADH 5560	1959-06-09	13 00	48	IIa-O	240
3	ADH 5570	1959-06-10	13 11	48	IIa-O	240
4	ADH 3936	1957-04-21	13 55	60	IIa-O	240
4	ADH 4191	1957-07-30	16 05	15	IIa-O	240
4	ADH 4192	1957-07-30	16 24	7	Agfa-Astro	240
5	ADH 3822	1957-03-11	14 13	60	IIa-O	240
5	ADH 3823	1957-03-11	14 52	5	IIa-O	240
5	ADH 3824	1957-03-11	15 22	15	IIa-O	240
5	USS15913	1977-03-24	16 24	20	103a-O	160
5	USS15963	1977-03-28	14 27	75	IIIa-J	500
5	USS15964	1977-03-28	15 42	20	IIIa-J	160
5	USS15965	1977-03-28	16 04	20	103a-O	160
5	USS15966	1977-03-28	16 19	6.5	103a-O	160

As standards for the classification the MK Atlas prints (1943) were used, but due to the overlap frequency and quality of the plates our classification is only one-dimensional, although in a few cases possible giants were identified. The following spectral lines were used most as criteria:

O5 - O9 : He II (4200 Å, 4541 Å) and He I (4471 Å)
B0 - B1 : He II (4686 Å) and He I (4026 Å, 4144 Å, 4471 Å)
B2 - B6 : He I (4009 Å, 4026 Å, 4144 Å, 4471 Å) and H-lines
B7 - B8 : H-lines
B9 - F2 : H-lines and Ca II K
F3 - G2 : H-lines, Ca II K and G-band
G3 - K1 : Ca II H,K and G-band
K2 - M5 : G-band, Fe II (4385 Å), Ca I (4226 Å) and TiO-bands.

Most of the stars (80%) have been classified on at least two different plates. The remainder of the stars were visible only on the plates having an exposure time of 48 or 60 minutes. The repeated classifications have been used to estimate the internal accuracy (see section 2.3, Table 8). The spectral types given in the Main Catalogue are weighted means, where the quality of the plates, the exposure times and the magnitude of the star have been taken in consideration.

As already mentioned, a number of stars (255) were too disturbed or underexposed to allow visual classification on the plates. For these stars the spectral types have been derived from their observed colours, B-V and U-B, with their reddening taken into consideration. In this procedure the slope of the reddening line given by Straizys et al. (1976) was used. The various possibilities for stars classified by this method have been carefully investigated, and the spectral types giving the best fit in the general reddening picture, as derived from the stars classified on the spectral plates, have been accepted. Spectral types determined by means of the colours are given within parentheses in the Main Catalogue.

So far, the classification of the stars has been one-dimensional. However, a number of the stars must be giants, and even some supergiants may be expected. This is evident in the diagram where the colour excess, E_{B-V}, is plotted versus true distance modulus (Figure 4). The diagram shows that some stars apparently close to the Sun have unreasonably high colour excesses. Further, from the table by Trumpler and Weaver (1953, p. 409) giving apparent luminosity - spectral type distribution, one finds that

down to $V=12^m$, more than 90% of the G and K stars ought to be giants, or in a few cases supergiants. Finally, the random distribution of fictive stars described in chapter 4 gives no star of spectral type later than G5 V within a volume corresponding to the observations.

It now remains to identify the giants or supergiants. For early type stars this has been a serious problem, and we can still not be sure that the right stars have been selected. However, for the late type stars the luminosity class given in the Main Catalogue should be well determined.

The method of determining luminosity class was the following. All stars with $U-B>0^m.70$ have been regarded as giants - the only exception is star no. 263 in field 1 - and the colours of the stars have been used in combination with the reddening line to derive the spectral type along the giant branch in the two-colour diagram. In spite of being treated as giants (III), some of the stars thus selected still showed an unreasonably high colour excess at the actual distance modulus. For these stars other possibilities for luminosity class were investigated and the one fitting best in the general reddening picture was accepted. In a similar way, some of the stars with $U-B<0^m.70$ and showing too high reddening have been assumed to be giants, or supergiants. In some cases, the Strömgren and Hβ photometry could be utilized in the determination of the luminosity class. The calibrations by Oblak et al. (1976) were then used. In addition, for F and B stars the calibrations by Crawford (1975b and 1978 respectively) were utilized.

At the investigations presented later on in this work, the luminosity class given in the Main Catalogue has been used. Accordingly, all stars with no indication under the column 'Giant' in the Catalogue, have been treated as main sequence stars.

As an illustration of the method described above, we give in Figure 4 for field 3 the positions of the giants if assumed to be main sequence stars (encircled dots) as well as the positions if assumed to be giants, or supergiants (circles). A comparison for stars in common with the Michigan Catalogue (1975 and 1978) is also given (Table 12, see section 2.4).

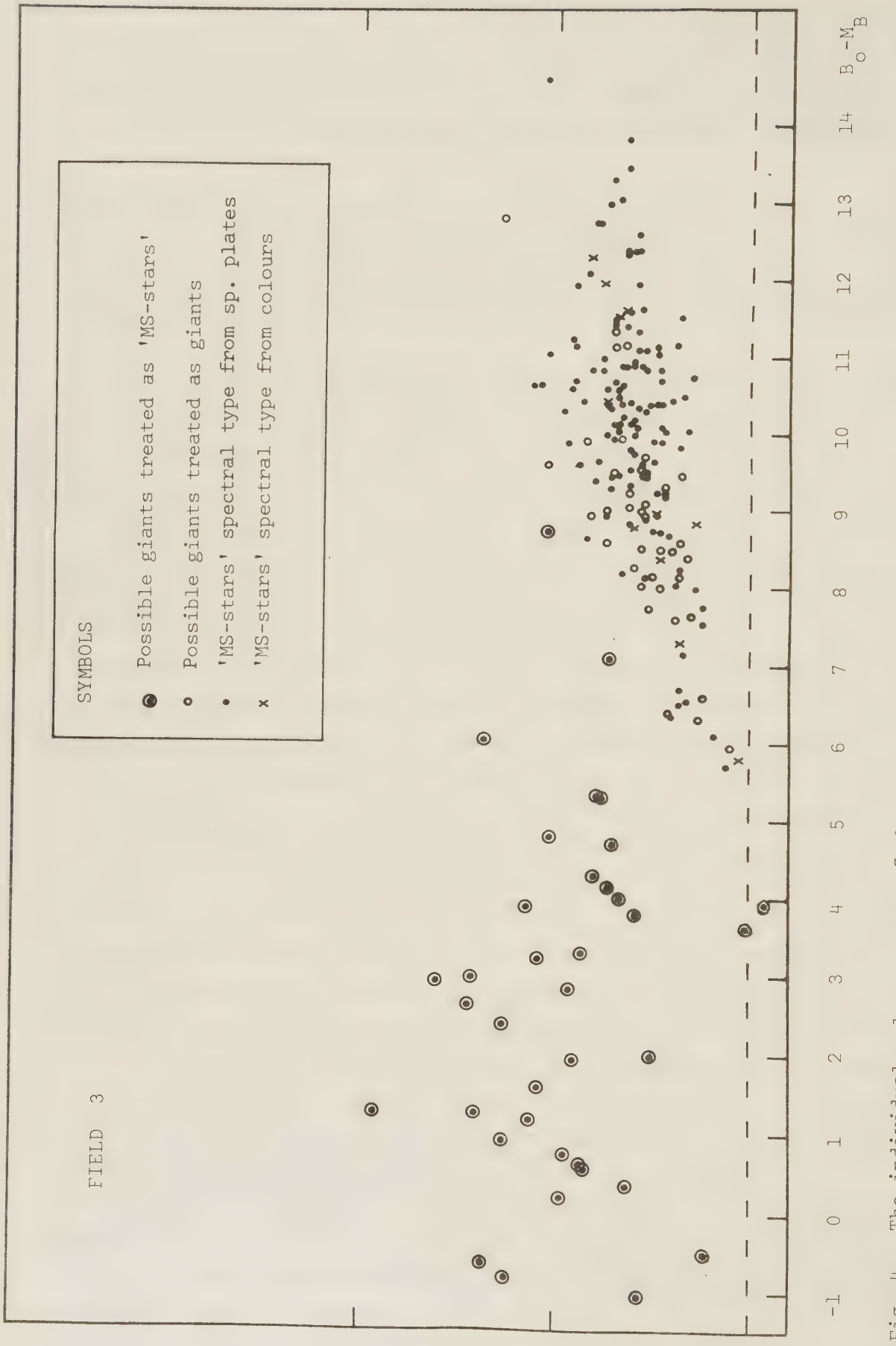


Fig. 4. The individual colour excess of the stars in field 3 versus the corrected distance modulus.

2.3 The quality of the material

One of the most serious problems connected with this kind of investigations is the uncertainty in spectral classification. Since the photometric quality is also of great importance, an estimate of the errors in the photometry, as well as in the spectral classification, has been made.

The magnitudes and colours of 190 of the stars were observed more than once in UBV (see Table 5). Of these remeasurements 97 were performed almost $1\frac{1}{2}$ years after the first observations. In addition, all but eight of the standard stars were different during the two observational runs (cf. Table 2).

Table 5. The number of photoelectrically reobserved stars in the various fields. (N is the number of observations.)

Field	N=2	N=3	N=4	N≥5	All
1	30	10	1	0	41
2	34	7	0	0	41
3	36	8	0	0	44
4	33	4	1	2	40
5	11	7	4	2	24
All	144	36	6	4	190

For each of the 190 stars the standard deviations in V, B-V and U-B were calculated from formula (1). Then the stars were divided into 15 groups according to magnitude and colour, and the mean value of the standard deviations within each group was calculated. In these calculations eight stars were excluded, five of them because they have too close neighbours influencing the photometry (field 1: stars nos. 15, 16, 293, 294 and field 2: star no. 147). The other three stars were excluded since they are suspected to be variable (field 3: star no. 30 and field 4: stars nos. 92, 158). Among the remaining stars, further three were disregarded in U-B, two because they are very red and thus too faint in U (field 2: star no. 164 and field 5: star no. 150) and one simply because it was only reobserved in B and V (field 3: star no. 13). The resulting mean values of the standard deviations for the 182 stars left (179 in U-B) are given in Table 6.

In a similar way, the mean values of the standard deviations for the Strömgren and Hβ photometry have been calculated. The result is shown in

Table 7. The number of stars utilized in these calculations (70) exceeds the number of stars given in the uvby,β Catalogue (49), because in 1975 this kind of photometry was performed for some stars, observed for similar purposes in other fields.

Table 6. The mean values of the standard deviation in V, B-V and U-B for 182 reobserved stars. (N=number of stars used within each group.)

	V	⩽9	9-10	10-11	11-12	>12
B-V	V	$0^m.008$	$0^m.010$	$0^m.016$	$0^m.018$	$0^m.026$
⩽0.5	B-V	0.008	0.007	0.017	0.017	0.023
	U-B	0.008	0.009	0.016	0.014	0.022
	N	9	15	28	41	30
0.5-1.0	V	0.009	0.012	0.013	0.016	0.018
	B-V	0.013	0.005	0.013	0.010	0.026
	U-B	0.011	0.008	0.016	0.021	0.028
	N	2	4	8	9	7
>1.0	V	0.011	0.007	0.011	0.016	0.060
	B-V	0.009	0.015	0.013	0.017	0.019
	U-B	0.020	0.012	0.024	0.045	0.063
	N	8	4	7	9	1

Table 7. The mean values of the standard deviation in uvby and Hβ photometry. (N=number of stars used within each group.)

Telescope		Standard deviation in					
		V	b-y	m_1	c_1	β	N
Danish 50 cm	V⩽9.00	$0^m.014$	$0^m.010$	$0^m.015$	$0^m.008$	$0^m.013$	16
	>9.00	0.020	0.009	0.012	0.019	0.021	26
ESO 50 cm	V⩽9.00	0.009	0.008	0.011	0.019	0.012	19
	>9.00	0.009	0.010	0.017	0.031	0.022	9

The internal dispersion in the spectral classification has been estimated for three different spectral groups. Totally 689 stars have been classified on more than one plate, and it was possible to calculate the mean value of the deviations from the accepted mean values of the spectral types. In this calculation the absolute amounts of the deviations were used. The result is given in Table 8.

Table 8. The internal uncertainty in the spectral classification.

O - B :	1.5 subtypes	N=376
A - F :	2.0 "	200
G - K :	3.5 "	113

Regarding the classification performed by means of the two-colour diagram, there is a possibility to check the quality, at least for the early types. This may be done by calculating the value of the slope of the reddening line (E_{U-B}/E_{B-V}) for stars classified on the spectral plates. The results may then be compared with the values given by Straizys et al. (1976) used in the classification. At the calculations all stars were treated as main sequence stars, and the intrinsic colours given by Schmidt-Kaler (1965) were used. The result is presented in Table 9 for five different spectral groups. Only stars with $E_{B-V}>0^m.30$ have been included.

Table 9. Mean values and corresponding mean errors of the slope of the reddening line for five different spectral groups. Only stars with $E_{B-V}>0^m.30$ have been included. (Number of stars used =N.)

	O5-B5	B6-A4	A5-F5	F6-G4	G5-K5
$\overline{(E_{U-B}/E_{B-V})}$	0.67 ±0.05	0.73 ±0.02	0.66 ±0.08	1.35 ±0.05	1.55 ±0.03
N	169	280	28	18	79
Straizys et al.	0.72	0.70	0.77	0.84	0.92

For the early type stars (O-F) the agreement with Straizys et al. is good, while for the other two groups the differences are considerable. This latter result is of course due to the fact that most of the stars of these two spectral groups are giants. If we classify a giant star of spectral type G or K as belonging to the main sequence (with the same spectral type) we get a too high value of the slope of the reddening line. This is shown in Table 10a, where the values given by Straizys et al. once again have been utilized. The resulting slopes are in accordance with the result shown in Table 9, and give an additional support to the statement that most of the late type stars observed here are giants.

The differences between Straizys et al. and the present work demonstrated in Table 9 may be interpreted by means of Table 10b, where the change of E_{U-B}/E_{B-V} caused by erroneous classification is given. The slope of the

reddening line is very sensitive to misclassification, especially for stars with minor reddening. From a comparison of this table with Table 9 it appears that in general the spectral classification for O, B and A stars is better than about 1 subtype and for F stars 2 subtypes. The use of the slopes, given by Straizys et al., during the classification by means of the two-colour diagram is thus expected to cause deviations from classification made on the plates that are less or at the most equal to these amounts.

Table 10a. The change in the slope of the reddening line, E_{U-B}/E_{B-V}, caused by erroneous luminosity classification as derived from Straizys et al. (1976).

True luminosity class		FOIII	GOIII	G5III	KOIII	K5III	GOIb	G8Ib
Assumed "	"	FOV	GOV	G5V	KOV	K5V	GOV	G8V
E_{B-V} = 0.30		1.11	1.23	1.31	1.36	1.61	1.60	1.45
0.40		1.02	1.14	1.23	1.29	1.55	1.46	1.40
0.50		0.97	1.09	1.18	1.24	1.49	1.37	1.36

Table 10b. The change in the slope of the reddening line, E_{U-B}/E_{B-V}, by erroneous spectral classification of main sequence stars as derived from Straizys et al. (1976).

True Sp. type		B0		A0		F0		G0	
Assumed Sp."		09.5	B0.5	B9	A1	A7	F2	F5	G5
E_{B-V} =	0.30	0.76	0.57	1.12	0.60	0.40	1.05	0.68	0.46
	0.40	0.75	0.61	1.03	0.63	0.48	0.96	0.71	0.59
	0.50	0.75	0.63	0.97	0.65	0.53	0.92	0.73	0.65

Note to Table 10: The slopes given in Table 10 have been calculated in the following manner. Starting with a given value of E_{B-V} and a "true" spectral type (say F0), which corresponds to a certain "correct" value of the slope E_{U-B}/E_{B-V}, we may calculate the colour excess in U-B and then the colours that would be observed (B-V and U-B). By misclassification the star gets erroneous intrinsic colours that in combination with the "observed" colours give the erroneous colour excess in B-V and U-B. From these excesses the slopes due to misclassification may be calculated.

2.4 Comparison with other observers

At a check of the zero-points of the photometry in UBV the Johnson and Morgan standards already mention were regarded as programme stars, and the magnitudes and colours in the present author's system were compared with the values given by Johnson and Morgan (1953). A comparison with other catalogues has also been made. The resulting mean values of the differences and corresponding mean errors are presented in Table 11, where the abbreviations mean the following:

KJ = the present work
MV = Moffat and Vogt (1975)
KN = Klare and Neckel (1977)
L1 = Lodén (1971)
L2 = Lodén (1973b)
JM = Johnson and Morgan (1953)
Ni = Nicolet (1978)

Table 11. Comparison with other observers. The mean values of the differences and corresponding mean errors are given. (N is the number of stars in common.)

Observers	Differences in V		B-V		U-B		N
KJ - MV[a)]	$-0^m.04$	$\pm 0^m.01$	$+0^m.03$	$\pm 0^m.01$	$-0^m.02$	$\pm 0^m.01$	47
KJ - KN	-0.02	0.00	0.00	0.01	0.00	0.00	7
KJ - L1	-0.07	0.02	+0.06	0.02	-0.01	0.02	6
KJ - L2	0.00	0.01	+0.03	0.01	-0.03	0.02	23
KJ - JM	0.00	0.00	+0.02	0.01	+0.04	0.01	5
KJ - Ni	0.00	0.01	+0.03	0.00	-0.01	0.01	45
ALL	-0.02	±0.02	+0.03	±0.01	-0.01	±0.02	127

a) Two more stars, HD 106730 and HD 116781, were identified in the catalogue by Klare and Neckel. They were, however, not included above since their deviations in V in both cases were about $0^m.15$.

From the table it is evident that the differences are small. It seems, however, as that there is a probably significant systematic difference in B-V of about +0.03 magnitudes. This result is somewhat confusing since the zero-point of the standard stars appears to be correct (cf. section 2.1). No correction has been made for this effect in the Main Catalogue.

A check of the spectral classification may be obtained by comparing the results for 41 stars in common with Nordström (1970). In addition, 189 stars in the fields 4 and 5 have been kindly classified independently by L.O. Lodén. The differences in this composite sample (230) are shown in Figure 5. It is evident that the spectral types given by the present author are systematically earlier than those given by Nordström and Lodén. The same effect is also evident in Figure 6, where we compare our classification with the Michigan Catalogue (1975). In this figure, the classes representing the present work are all regarded as being of luminosity class V, i.e. possible giants are treated as dwarfs. However, in Table 12 we give a comparison between the two-dimensional spectral classification according to the method described in section 2.2 and the classification given in the Michigan Catalogue (1975 and 1978). A few of the HD stars in common have been excluded at this comparison, since their spectral types are from the HD Catalogue. In Table 13 a more detailed investigation of the data used in the Figures 5 and 6 is presented.

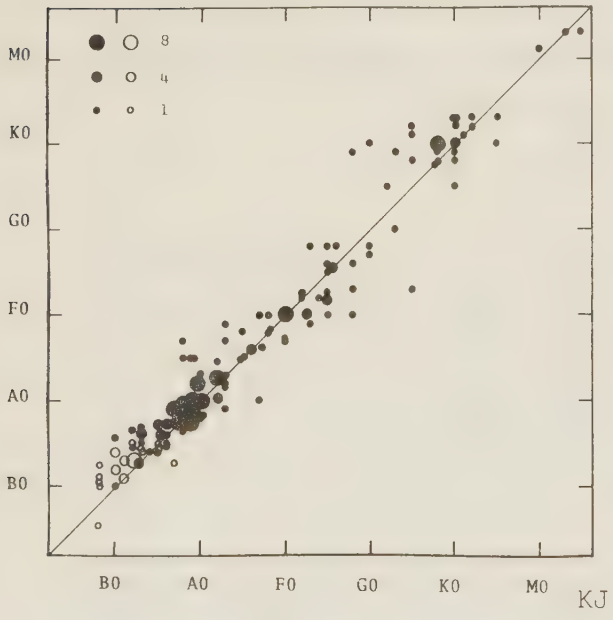


Fig. 5. A comparison of spectral classification with Nordström (open circles) and Lodén (filled circles). The line drawn indicates identical spectral types.

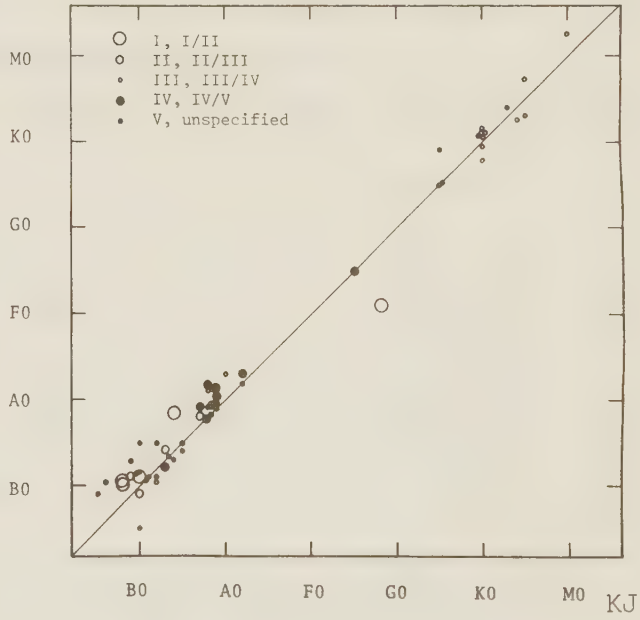


Fig. 6. A comparison of spectral classification with the Michigan Catalogue (1975). The line drawn indicates identical spectral types (regardless of luminosity).

Table 12. Comparison of the luminosity classes obtained by the present author (KJ) with the Michigan Catalogue (1975 and 1978) for stars in common.

HD	Michigan	KJ	HD	Michigan	KJ
97223	B3 V	B4	107592	K1 III	K2 III
97237	G8 III	K1 III	107720	K1 III	K1 III
97253	O5f	B0 II	107790	B2 IV/V	B3
97284	B0/1 Iab/b	O8	107945	K1/2 III	K1 III
97381	B1 III	B1	116314	B5V	B5
97434	O9	O5	116374	B9 IV	B8-9
97581	B1/2 Iab	B0	116456	B8 IV/V	B8
97707	B1/2 Ib	B0 Ib	116589	B7/9 II/III	B7
100098	A1 III	A0 III	116607	B9 III	B9
100162	B8/A0 V	B8	116734	F5 IV/V	F5
100163	A1/2 IV/V	B8-9	116781	O9/B1 (I)e	O9 Iab(e)
100200	B9 IV	B7	116795	B3/5 (V)	B5
100243	B0/2	B2	116827	B2/5 (Vn)	B3
100263	B1/2 III/IV	B0	116841	K3 (III)	K5 III
100295	K0/1 III	K1 III	116888	A0/1 (IV)	B9
100444	O9 II	B0 II	116951	A3 IV/V	A2
100495	B1 III	B1	117000	F0/2 Ia	G0 II
100791	K2/3 (III)	K3 III	117059	K0/2	K0 III
106730	B(0/1)e	O6	117134	B0/1 (IIIn)	B2
106781	B3/7	B2	117185	B8 III	B8
106796	A1/2 Vn	B8-9	117195	G8/K0	G5
106874	G8/K1 (III)	K1 III	117196	A2 III/IV	A2
106984	K3/5	K5 III	140221	B9 V	B9
107050	A3 III/IV	A1 II	140222	B9 III	B7
107111	A1/2 IV/V	B8	140288	B3/5 III	B5
107154	B8/9 Ib	B4	140289	K1 III	K0 III
107190	K5/M0 (III)	M0 III	140354	K4 III	K5 III
107223	B9.5 V	B9	140447	A0 IV	B9
107269	M3 (III)	K5 III	140582	B9 V	B9
107270	G5p Ba	G5 II	140605	B5/7 IV	B5
107300	B3/7	B0	140620	B9 II/III	B6
107338	A2 V	B8	140621	F6 V	F0
107357	G5 III	G5 III	140622	A0 V	B8-9
107527	B3/5 II	B3	140678	F0 V	A8
107565	B1 II/III	O9	140741	B9 II/III	B7
107581	B3 III	O9	140979	K2/3 III	K3 III

Table 13. Mean values of the differences between spectral types given in the Main Catalogue (col. Sp) (KJ) and spectral types given by Lodén (L), Nordström (No) or Michigan Catalogue (M).(Unit=subtype, N=number of stars.)

Spectral group (KJ)	KJ - L			KJ - No			KJ - M		
	mean	s.d.	N	mean	s.d.	N	mean	s.d.	N
O5 - B1	0.0	---	1	-1.6	±1.7	25	-1.6	±2.6	14
B2 - B6	-1.1	±1.4	18	-1.2	±0.9	15	-0.5	±1.9	13
B7 - B8	-0.8	±1.8	23	+4.0	---	1	-1.9	±1.3	14
B9 - F2	-0.3	±2.1	89				-1.4	±1.8	11
F3 - G2	+0.6	±4.6	23				+3.5	±4.9	2
G3 - K1	-1.3	±3.4	28				-0.7	±1.5	11
K2 - M5	+1.0	±2.2	7				-0.4	±2.0	7

The spectral types given in the Main Catalogue have not been corrected for the effects appearing in Table 13. However, the influences of these systematic differences on the various investigations presented in this work will be discussed briefly in connection with the actual problem. Here we just want to point out that for the late type stars the differences are of minor interest, since most of these stars are giants with essentially the same luminosity.

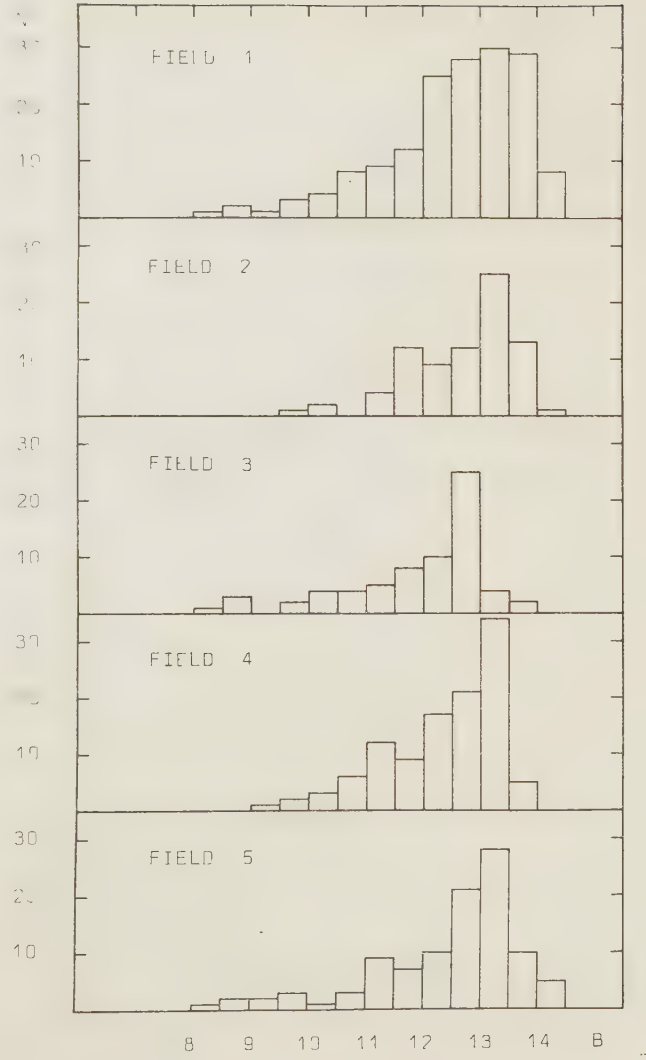
2.5 Some additional information on the fields

We have given the limiting magnitude, B_L, and the magnitude of completeness, B_C, for the five fields in Table 1. As a complement to this, we show the distribution of the stars according to different B magnitude intervals in Figure 7. We use B magnitudes in this figure as well as in some of the investigations presented below because the stars were selected on B plates. From the figure it is evident that in the inner region of field 3 we do not observe as many faint stars as in the other fields. It is also obvious that we observe most faint stars in field 1 and that this field contains more stars than any of the other fields in spite of being the smallest of them all. From the figure it also appears that the magnitudes of completeness, B_C, may be somewhat fainter than given in Table 1.

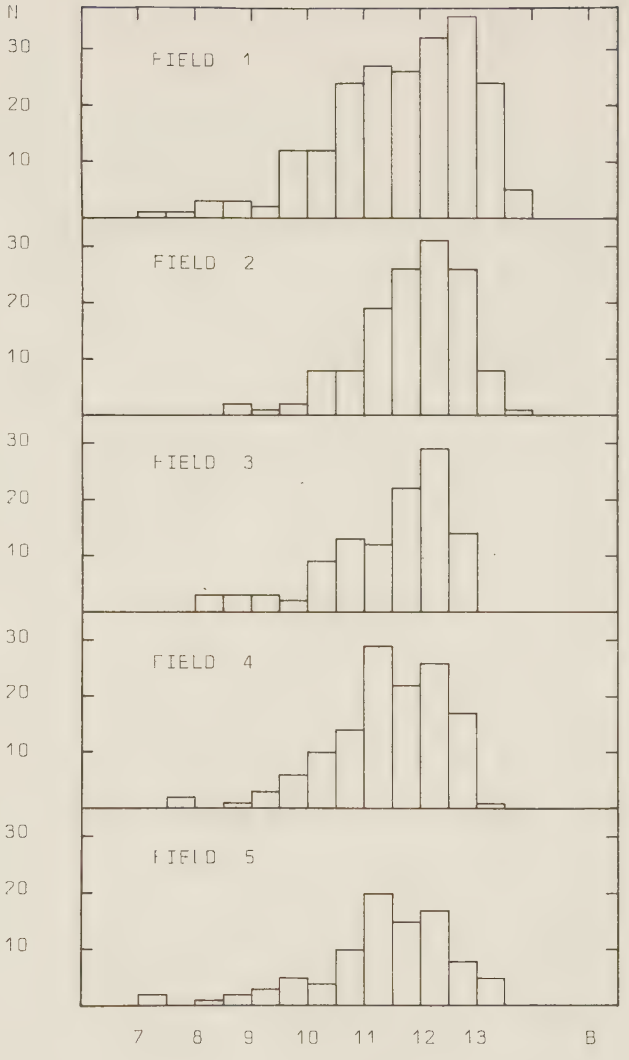
For 832 stars classified on the spectral plates we have calculated the percentual number of stars observed within different spectral type intervals (regardless of luminosity class, i.e. as given in the column 'Sp' in the Main Catalogue). The results are shown in Figure 8. It appears from this figure, that the fields 1-4 are rather similar, while in field 5 there is an excess of F stars and a lack of early type stars. We must keep in mind that field 1 is about half as big as the other fields, which partly explains that there are rather few late type objects.

The two-colour diagrams of the fields are shown in Figure 9, where the full-drawn line represents the ZAMS objects and the dashed line represents the giants of luminosity class III, both curves according to the calibrations by Schmidt-Kaler (1965). It appears from this figure that field 3 is more homogeneous than the other fields. This is probably due to the effects mentioned in connection with Figure 7 above. In Figure 9 we also see that the reddening has a kind of "knee" around $U-B=-0^m.2$ indicating a reddening difference between early and late B stars (cf. section 3.1). In field 5 the lack of early type stars, as well as the richness of A-F stars, is clearly demonstrated (cf. Figure 8).

Finally, Figure 9 gives a strong support to the assumption that practically all stars with U-B>$0^{m}.70$ are giants, since there is a clearly visible "knee" at this value, especially in fields 2, 4 and 5. The use of this limit in U-B for selecting late type giants has also been made by others (Schnur 1970).



7 (a) Smaller Regions



7 (b) Larger Regions

Fig. 7. The observed numbers of stars with different B-magnitudes. (a) Smaller Regions, (b) Larger Regions.

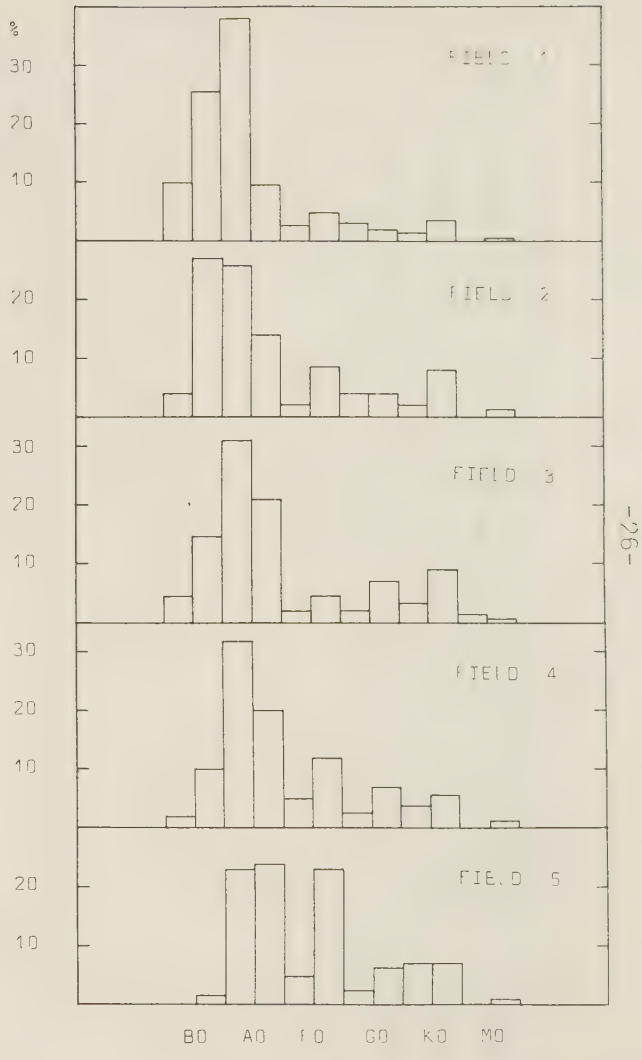


Fig. 8. Relative frequences of stars with different spectral type (only stars classified on spectral plates).

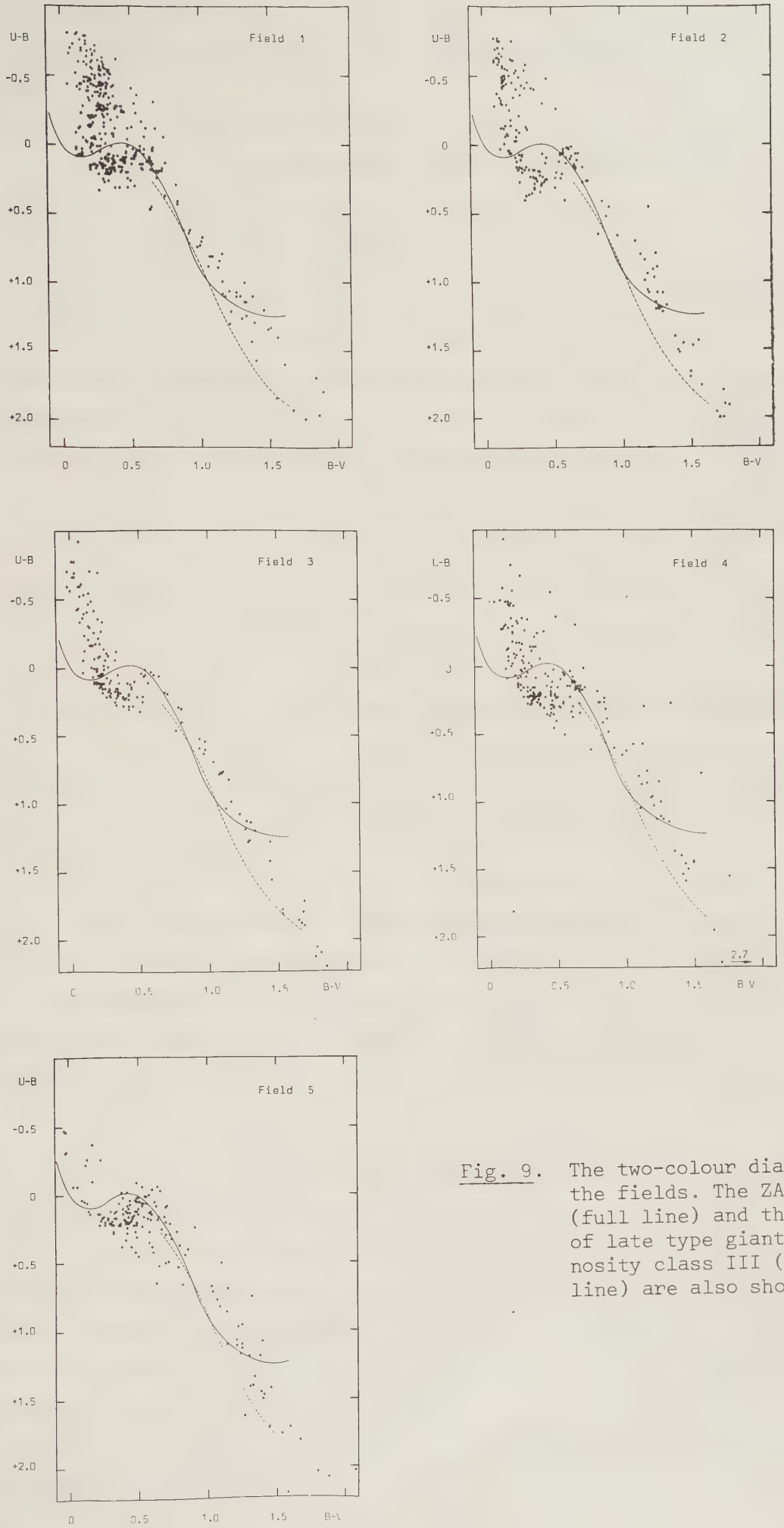


Fig. 9. The two-colour diagrams of the fields. The ZAMS curve (full line) and the curve of late type giants of luminosity class III (dashed line) are also shown.

3. RESULTS OF THE INVESTIGATIONS

From the observational data, the individual distances of the stars have been calculated using the well known relation

$$V - M_V = 5 \log r - 5 + A_V(r) \qquad (3)$$

where we take $A_V = 3.2\ E_{B-V}$, see for example Moffat and Schmidt-Kaler (1976). The intrinsic colours and absolute magnitudes are from the calibrations by Schmidt-Kaler (1965). The resulting distances are used in the investigations that follow below. In most of the studies, we have separated the material into three groups, hereafter referred to as MSp, MSc and G. The abbreviations stand for

MSp: main sequence stars, as judged from the spectral plates and the reddening,

MSc: main sequence stars, as judged from the colours and the reddening,

G : possible giants, as judged from the criteria mentioned in section 2.2.

3.1 The colour excess in the various fields

The mean values and the corresponding mean errors of the colour excesses have been determined for different intervals of the extinction-corrected distance modulus. The results for the MSp- and G-groups are shown in Figure 10, where we have also drawn the curve representing the mean of the mean values of the colour excesses for all fields (MSp-group only), each with a weight equal to 1. Those parts of the curve where only 2, 3 or 4 fields could be utilized, are shown as dashed lines. We did not include the MSc-group in the figure, since the reddening was of crucial importance when selecting spectral type among the two, or sometimes three possible alternatives.

Summarizing the general features appearing in Figure 10, we know very little about how close to the Sun the reddening begins, as the number of nearby stars in this material is small. In any case, the colour excess has reached a value of about $0^m.15$-$0^m.20$ within the true distance modulus interval 6^m-7^m (150-250 pc), with the possible exception of field 1. All fields have $E_{B-V} = 0^m.30$-$0^m.35$ in the interval $V_o - M_V = 9^m$-$9^m.5$ (0.6-0.8 kpc). Thereafter they differ somewhat. In the fields 2 and 3 the colour excess remains constant out to at least $V_o - M_V = 13^m$ (4 kpc), and in field 4 at least out to $V_o - M_V = 11^m.5$ (2 kpc), while in field 5 there seems to be a steady increase

reaching $E_{B-V}=0^m.45$ at $V_o-M_V=11^m.0$ (1.5 kpc). Regarding field 1, there seems to be a steady rise of the colour excess out to at least $V_o-M_V=13^m$ (4 kpc), where $E_{B-V}=0^m.53$.

Thus most of the reddening occurs at distances closer to us than around 0.8 kpc in three of the fields (cf. chapter 5). The steady increase in reddening in field 1 may, however, be somewhat erroneous, as we shall see below, where a more detailed analysis of the colour excess has been performed.

All stars in the MSp-group have been separated into six of the spectral groups given in Table 13 (no stars of K2-M5 appear in the MSp-group), and the reddening of these groups for different distance moduli has been determined. As an example, the results regarding the fields 1 and 2 are given in the Tables 14a and 14c. The different spectral groups give essentially the same reddening at various distance modulus intervals in the fields 2-5, although a few of the stars deviate so much ($0^m.15$) that they may be more luminous, or of another spectral type than given in the Main Catalogue (field 2: nos. 11, 24, 153, 154, 189 and field 4: nos. 154, 181). However, in field 1 there is a systematic difference of about $0^m.10$ between the spectral group B9-F2 and the early type spectral groups (see Table 14a) within the distance interval in common. The latter spectral groups agree quite well with one another, and give a higher value of the colour excess with a mean of $E_{B-V}=0^m.43$.

Having Table 13 in mind, one might suspect a possible misclassification to be the cause of the phenomenon, but if this is the case, there ought to be a systematic effect in all fields. Since this has not been observed, there must be another explanation. Nevertheless, we have checked if the possible misclassification changes the reddening in field 1. This was done by correcting the spectral types of the MSp-group stars with the amounts given in Table 13. These "Michigan-types" have been used to obtain absolute magnitudes and intrinsic colours, from which new colour excesses and extinction-corrected distance moduli of the stars have been calculated. The results are shown in Table 14b. From a comparison between the Tables 14a and 14b it is clear that the reddening in field 1, as well as the systematic difference mentioned above remains all the same. We conclude therefore that the phenomenon is probably the result of varying extinction over

the field, in spite of the field 1 being the smallest of them all. Accordingly, we have to look more carefully at the distribution of the stars in question in field 1.

In Figure 11 we show the location of the MSp-group stars in field 1 within the true distance modulus interval $11^{m}.0$-$11^{m}.5$ (1.5-2 kpc). It seems that we are looking through a "window" in the central part of the field, where Trumpler 18 is situated (cf. section 3.3), allowing us to see rather many distant B9-A0 stars. The adjacent stars of earlier spectral types also show minor reddening compared to the lower parts (SW, S, SE). Similar investigations of other intervals in distance modulus give the same result.

In summary, the central part of field 1 has $E_{B-V}=0^{m}.33$ from 0.8 kpc to 2.0 kpc. In the other parts there seems to be a steady, but rather slow increase reaching a value of $E_{B-V}=0^{m}.43$ at 2 kpc. A few of the early type stars give too high colour excesses as compared with adjacent B9-A0 stars and might be more luminous or of another spectral type than given in the Main Catalogue (field 1: nos. 87, 97, 192, 258, 310 and 311).

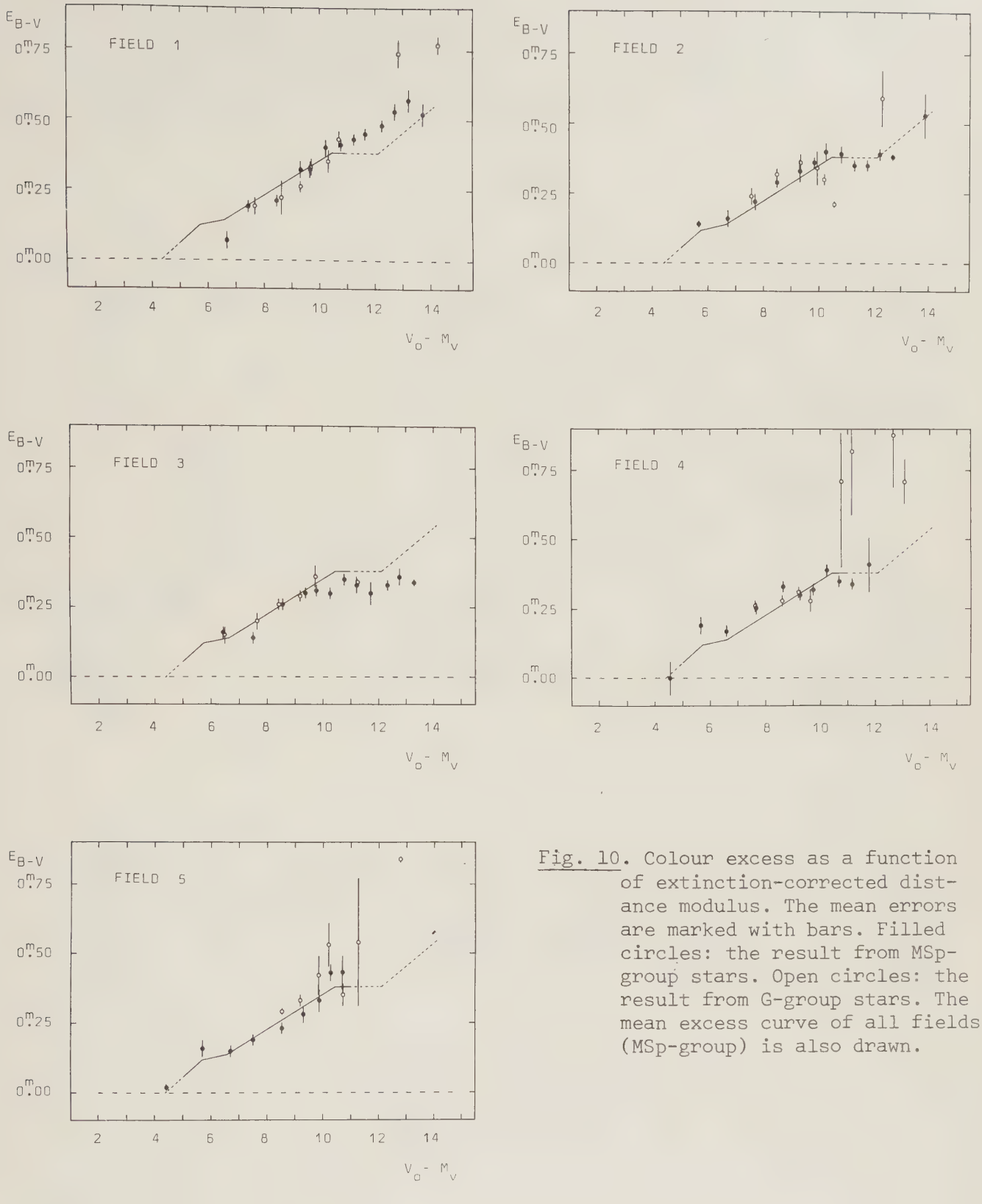


Fig. 10. Colour excess as a function of extinction-corrected distance modulus. The mean errors are marked with bars. Filled circles: the result from MSp-group stars. Open circles: the result from G-group stars. The mean excess curve of all fields (MSp-group) is also drawn.

Table 14. The colour excesses for different spectral groups as a function of extinction-corrected distance modulus.
(a) Field 1. Spectral types according to the Main Catalogue.
(b) Field 1. Spectral types "corrected" to "Michigan types".
(c) Field 2. Spectral types according to the Main Catalogue.

14 (a)

V_o-M_V	O5-B1		B2-B6		B7-B8		B9-F2		F3-G2		G3-K1		O5-K1	
	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N
6.0 - 7.0							0.08	1	0.11	1	0.01	1	0.07 ±0.03	3
7.0 - 8.0							0.26	1	0.17 ±0.02	5			0.19 ±0.02	6
8.0 - 9.0							0.22 ±0.02	14	0.18 ±0.03	5			0.21 ±0.02	19
9.0 - 9.5			0.29 ±0.04	2	0.23	1	0.37 ±0.02	3					0.32 ±0.03	6
9.5 -10.0					0.42 ±0.05	4	0.27 ±0.04	10					0.32 ±0.03	14
10.0 -10.5	0.41	1	0.45 ±0.05	6	0.47 ±0.08	3	0.33 ±0.02	7					0.40 ±0.03	17
10.5 -11.0	0.34 ±0.01	2	0.47 ±0.03	9	0.42 ±0.02	17	0.34 ±0.03	9					0.41 ±0.02	37
11.0 -11.5	0.62 ±0.03	3	0.50 ±0.02	19	0.39 ±0.03	10	0.31 ±0.01	13					0.43 ±0.02	45
11.5 -12.0	0.55	1	0.48 ±0.02	12	0.45 ±0.05	5	0.23	1					0.45 ±0.02	19
12.0 -12.5	0.51 ±0.03	9	0.44 ±0.02	8									0.48 ±0.02	17
12.5 -13.0	0.53 ±0.04	6	0.52 ±0.03	2									0.53 ±0.03	8

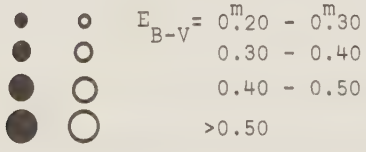
14 (b)

V_o-M_V	O5-B1		B2-B6		B7-B8		B9-F2		F3-G2		G3-K1		O5-K1	
	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N
6.0 - 7.0							0.05	1	0.18	1	0.00	1	0.08 ±0.05	3
7.0 - 8.0							0.24 ±0.01	2	0.26 ±0.03	3			0.25 ±0.01	5
8.0 - 9.0			0.23	1			0.21 ±0.02	17	0.18 ±0.03	5			0.21 ±0.01	23
9.0 - 9.5			0.41 ±0.07	4			0.30 ±0.03	13					0.33 ±0.03	17
9.5 -10.0			0.43 ±0.07	4			0.28 ±0.02	21					0.31 ±0.02	25
10.0 -10.5			0.48 ±0.04	6	0.28	1	0.32 ±0.03	17					0.36 ±0.03	24
10.5 -11.0			0.48 ±0.02	16			0.29 ±0.02	25					0.36 ±0.02	41
11.0 -11.5	0.51 ±0.03	2	0.51 ±0.02	22	0.42 ±0.01	2	0.25 ±0.05	4					0.47 ±0.02	30
11.5 -12.0	0.45 ±0.03	3	0.46 ±0.02	15	0.41	1							0.45 ±0.02	19
12.0 -12.5	0.45 ±0.06	2	0.46 ±0.03	4									0.45 ±0.02	6
12.5 -13.0	0.53 ±0.04	2	0.57 ±0.11	2									0.55 ±0.05	4

14 (c)

V_o-M_V	O5-B1		B2-B6		B7-B8		B9-F2		F3-G2		G3-K1		O5-K1	
	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N	E_{B-V} m.e.	N
6.0 - 7.0									0.16 ±0.03	5			0.16 ±0.03	5
7.0 - 8.0							0.29 ±0.05	3	0.17 ±0.02	5			0.22 ±0.03	8
8.0 - 9.0					0.22	1	0.31 ±0.03	8	0.25	1			0.29 ±0.02	10
9.0 - 9.5					0.25	1	0.35 ±0.04	3					0.33 ±0.04	4
9.5 -10.0							0.36 ±0.02	7					0.36 ±0.02	7
10.0 -10.5			0.50 ±0.04	2	0.39 ±0.09	3	0.37 ±0.04	7					0.40 ±0.03	12
10.5 -11.0			0.55 ±0.05	2	0.41 ±0.03	2	0.34 ±0.02	7					0.39 ±0.03	11
11.0 -11.5			0.39 ±0.02	10	0.35 ±0.02	7	0.29 ±0.03	5					0.35 ±0.02	22
11.5 -12.0	0.43	1	0.36 ±0.02	10	0.29 ±0.01	3	0.38	1					0.35 ±0.02	15
12.0 -12.5			0.39 ±0.01	15	0.24	1							0.39 ±0.02	16
12.5 -13.0	0.41 ±0.01	3	0.36 ±0.01	4									0.38 ±0.01	7

Figure 11. Field 1. The colour excesses of the MSp groups stars situated in the distance interval 1.6-2.0 kpc. Open circles represent B9-A0 stars and filled circles represent stars of earlier spectral type.



3.2 The distribution of the stars in the various fields

The number of stars has been counted for each field within various intervals of the extinction-corrected distance moduli. This has been performed for each of the three groups MSp, MSc and G. As we have observed down to different limiting magnitudes in the smaller and larger regions of the fields (cf. Table 1), the material has been separated into two groups in each field, smaller region (s.r.) and larger region (l.r.). Consequently, bright stars in the smaller region have been counted twice, and the number of stars counted in both regions together exceed the number of stars observed in the actual field. The resulting numbers for the different groups are shown as histograms in the Figures 12 - 16.

An attempt to determine the space density of the B8-A3 stars, as well as of the G5-K2 III stars, has also been made, simply by counting the number of stars within various distance modulus intervals and dividing these numbers with the corresponding volumes. This method does not account for the uncertainties in the distance determinations. In order to increase the number of stars within each distance modulus interval, we have put fields 1, 2 and 3 respectively 4 and 5 together, thus forming two "field groups". Nevertheless, the stars are too few to allow a determination of how the space density changes with distance, but we may get a rough estimate of the space density out to the distance within which the material is expected to be complete.

The resulting space density of B9-A3 V stars (MSp+MSc) in the fields 1-3 is 0.37 stars/1000 pc^3 for the smaller regions (N=7, $B<12^m.2$, $V_o-M_V=4^m-9^m.5$) and 0.32 stars/1000 pc^3 for the larger regions (N=10, $B<11^m.3$, $V_o-M_V=4^m-9^m$). In the fields 4-5 the density is about twice as much, namely 0.61 stars/1000 pc^3 for the smaller regions (N=11, $B<12^m.2$, $V_o-M_V=4^m-9^m.5$) and 0.66 stars/1000 pc^3 for the larger regions (N=20, $B<11^m.3$, $V_o-M_V=4^m-9^m$). If we do not believe that the difference between the fields is significant, we may put them all together and obtain a density of about 0.48 stars/1000 pc^3 with almost no difference (≤ 0.01) between the smaller and larger regions. There is an indication of a rise of the density in the interval $V_o-M_V=10^m-10^m.5$ for all fields, reaching a value of 0.50 stars/1000 pc^3 (N=37, $B<13^m$ and $B<12^m$ in smaller and larger regions respectively). This result may be fictitious as it would disappear if we "correct" the spectral types using Table 13. Such a change of the spectral types will of course increase the space density as the distances of the stars would shrink and more stars

would fall within the distance out to which the material is regarded as complete. The densities given above may therefore be the lower limit. As a measure of the uncertainties in the densities given above one may use $N^{-1/2}$, where N is the number of stars. In this connection we want to point out that the diameters of the fields are probably better than ±0!5, which corresponds to an error of 5% in the calculation of the volumes. The space density of B8-A3 stars given above is about the same as obtained by McCuskey and Lee (1976).

The space density of G5-K2 giants (III) has also been determined. There seems to be twice as many giants in the fields 1-3 than in the fields 4-5 but also here we have to be very cautious, since the number of stars is very small. However, putting all fields together, but separating smaller and larger regions we arrive at the following densities:

1.17 stars/1000 pc^3 (N=11, $B<12^m.2$, $V_o-M_V=4^m-8^m.5$)

1.10 stars/1000 pc^3 (N=17, $B<11^m.3$, $V_o-M_V=4^m-8^m$)

for the smaller and larger regions respectively. This result is about 4 times the density obtained by Drilling (1968). Although our method is rough, it is hard to understand this disagreement. One explanation might be that the local differences are large - our fields are certainly small.

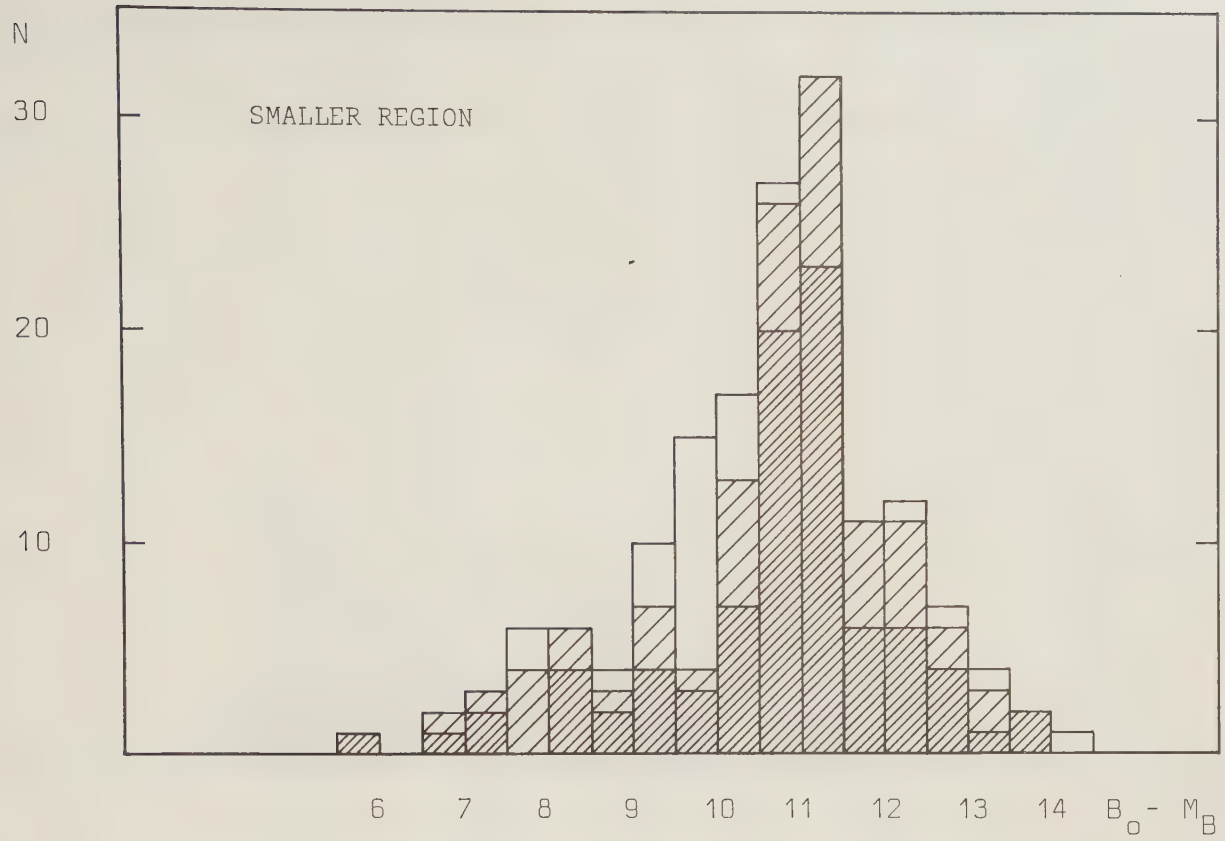
Finally we have looked at the distribution of stars according to the absolute magnitude in blue, M_B, using Table 19 in Appendix A. According to the picture given by Humphreys (1976) the Carina spiral arm is about 1.5, 1.4, 1.2, 1.1 and 1.0 kpc from the Sun in the direction of the fields 1, 2, 3, 4 and 5 respectively, and therefore the material has been separated into two groups -- one containing stars out to the spiral arm, one within and possibly beyond the spiral arm (out to 4 kpc). As earlier we have studied smaller and larger regions separately (down to $B=12^m.2$ and $11^m.3$ respectively). The reason for this separation is that the material is complete down to different magnitudes. All stellar groups (MSp, MSc and G) have been included. The result is given in Table 15. From this table it is obvious that most of the very luminous stars are found in field 1 while none is found in field 5. It is also evident that most of the luminous stars are found inside or possibly beyond the spiral arm, and that very few stars around B9 are seen so far out as the spiral arm, down to the magnitude of completeness.

Table 15. The observed numbers of stars for different luminosity groups - down to the magnitude of completeness (smaller regions: $12^m.2$; larger regions: $11^m.3$). Only stars within 4 kpc are regarded.

		OUT TO THE SPIRAL ARM										WITHIN AND POSSIBLY BEYOND THE SPIRAL ARM									
		Smaller Regions					Larger Regions					Smaller Regions					Larger Regions				
M_B	Field	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-6												1					4	1		2	
-5												4	2	2	1		11	2	2	2	
-4							2						1		1		9	3			
-3							1					3	2	1	1		8	5	2	2	
-2		4			1		8	2	1	1		2	9	4	4		1	8	6	2	1
-1		9		1	3	3	4	2	3	7	6	4		3	8				4	2	1
0		9	1	5	2	5	8	3	7	11	7			3	2	2					
1		1	1	2	2	1	2	1	3		5										
2		3	2	8	6	8	7	5	10	11	11										
3		2	2		1	5	1			3	3										
4		2	1	1	4	3		1	1	3	1										
5			1		2	2			1	1											
6										2	1										
7						1					1										

Figs. 12-16. The numbers of stars in various intervals of the extinction-corrected distance modulus.

- G-group stars (suspected giants).
- MSc-group stars (spectral type from colours).
- MSp-group stars (spectral type from plates).



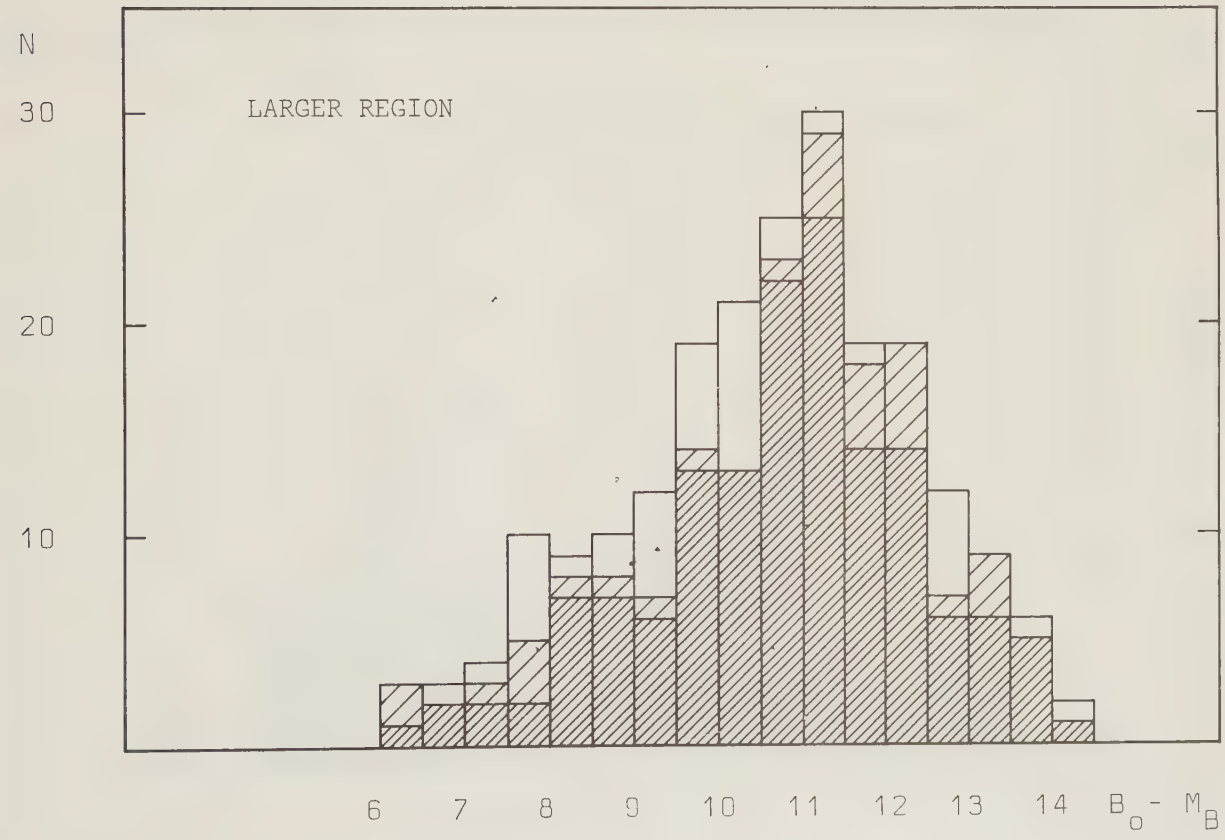
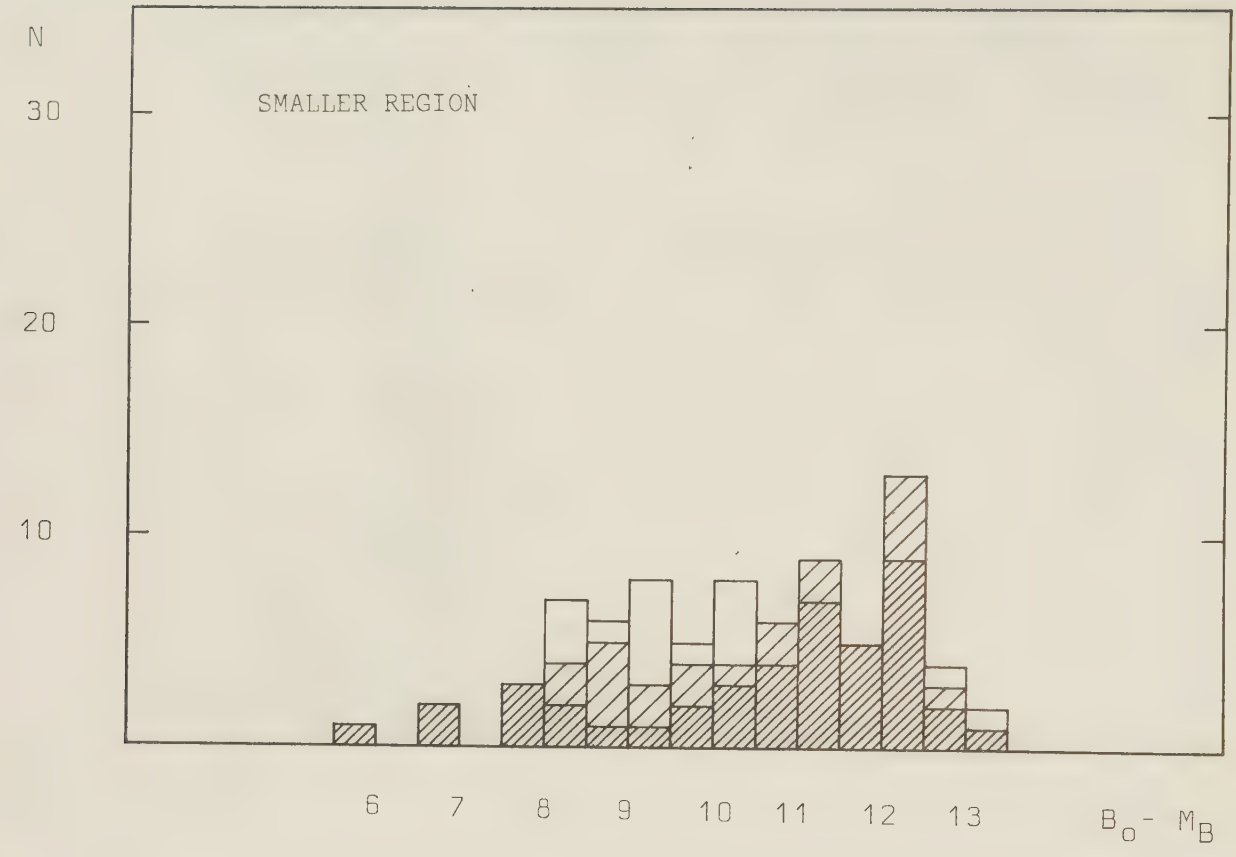


Fig. 12. Field 1.



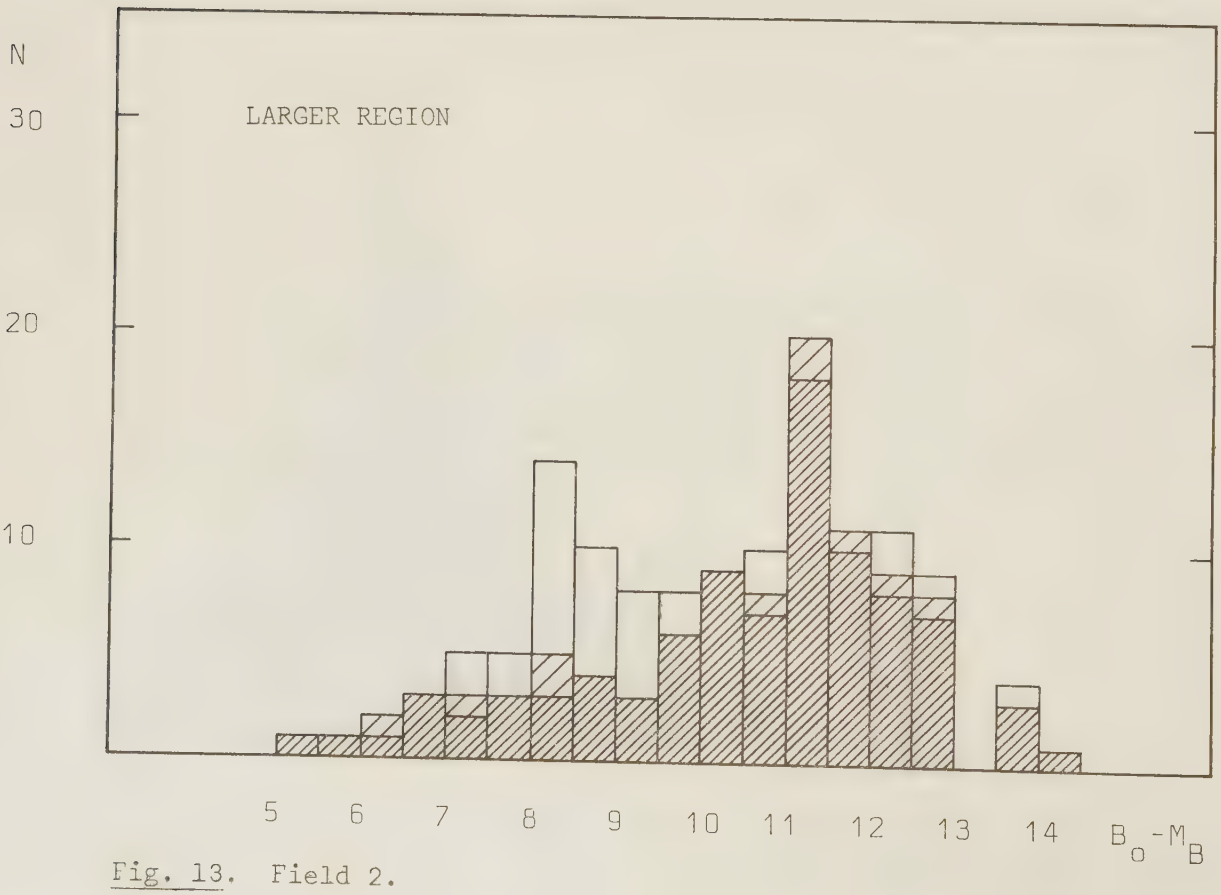
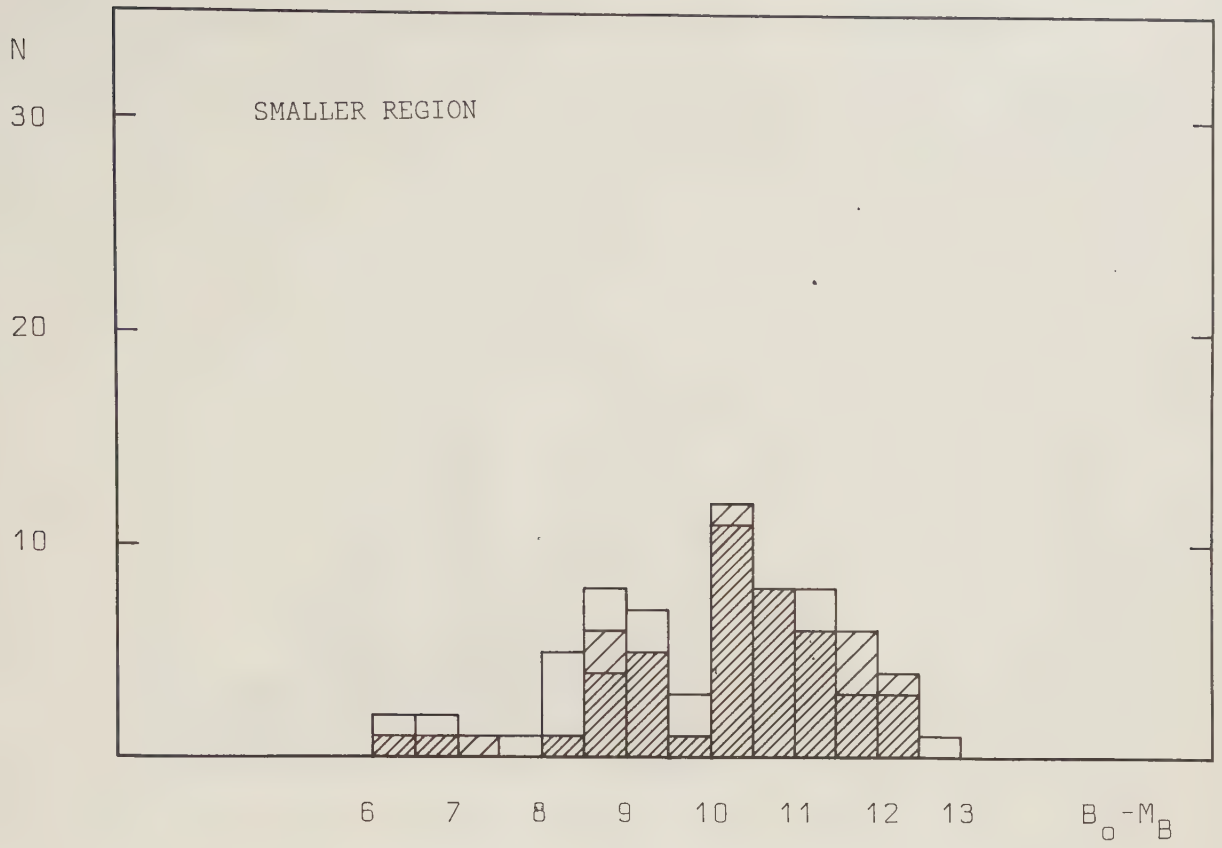


Fig. 13. Field 2.



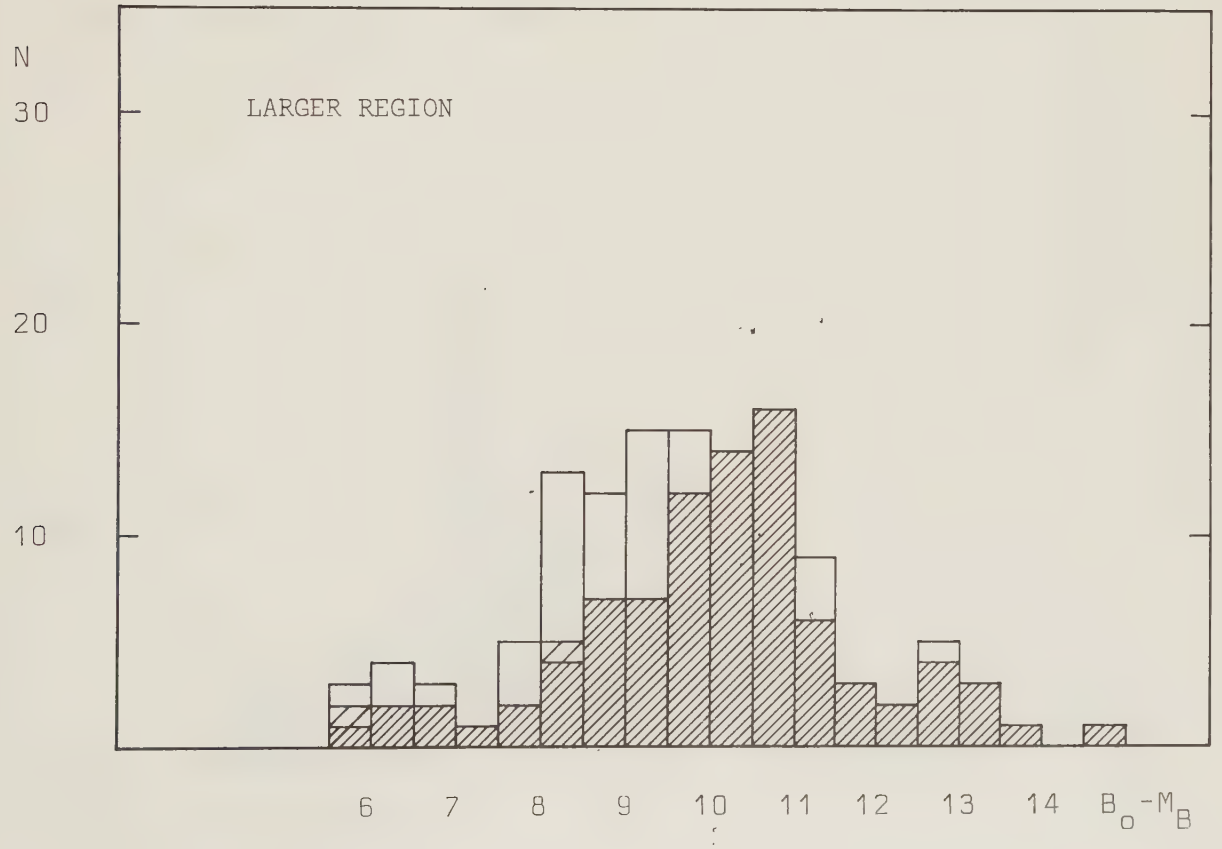
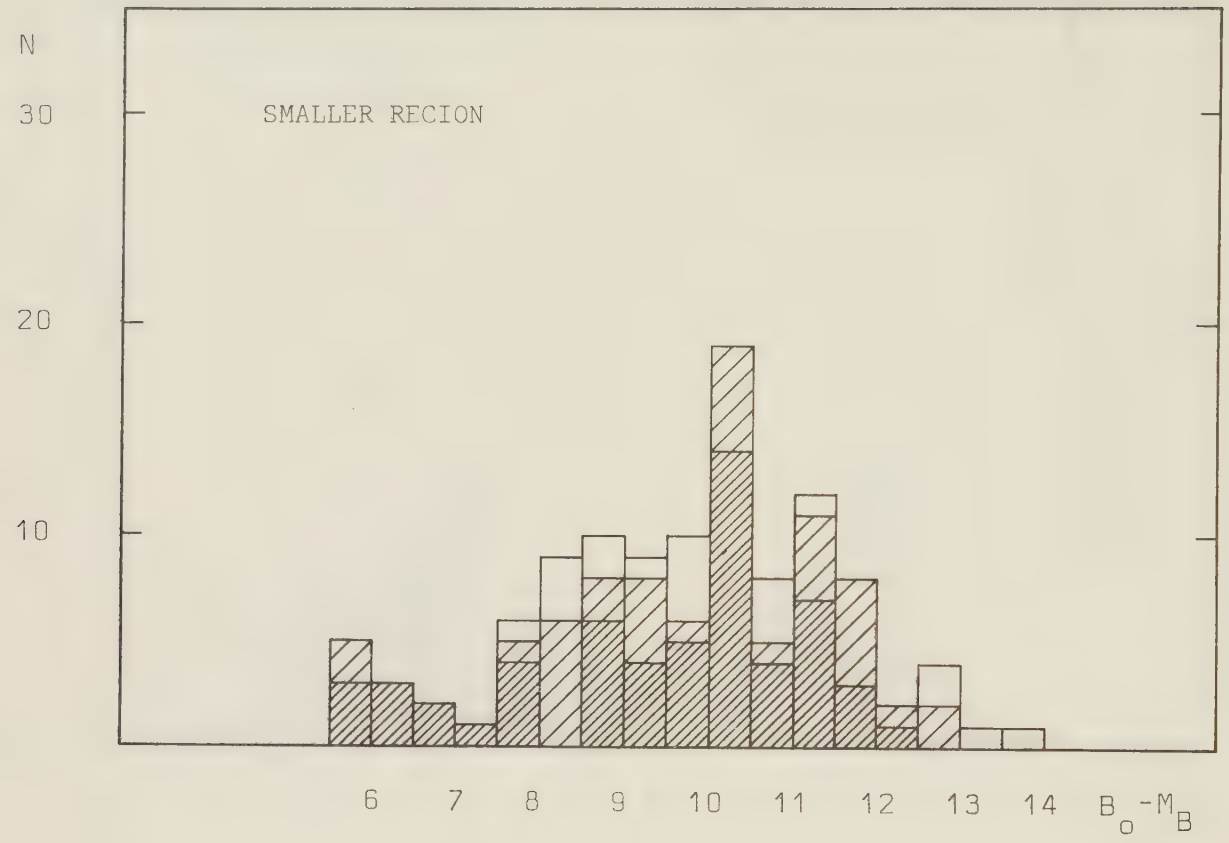


Fig. 14. Field 3.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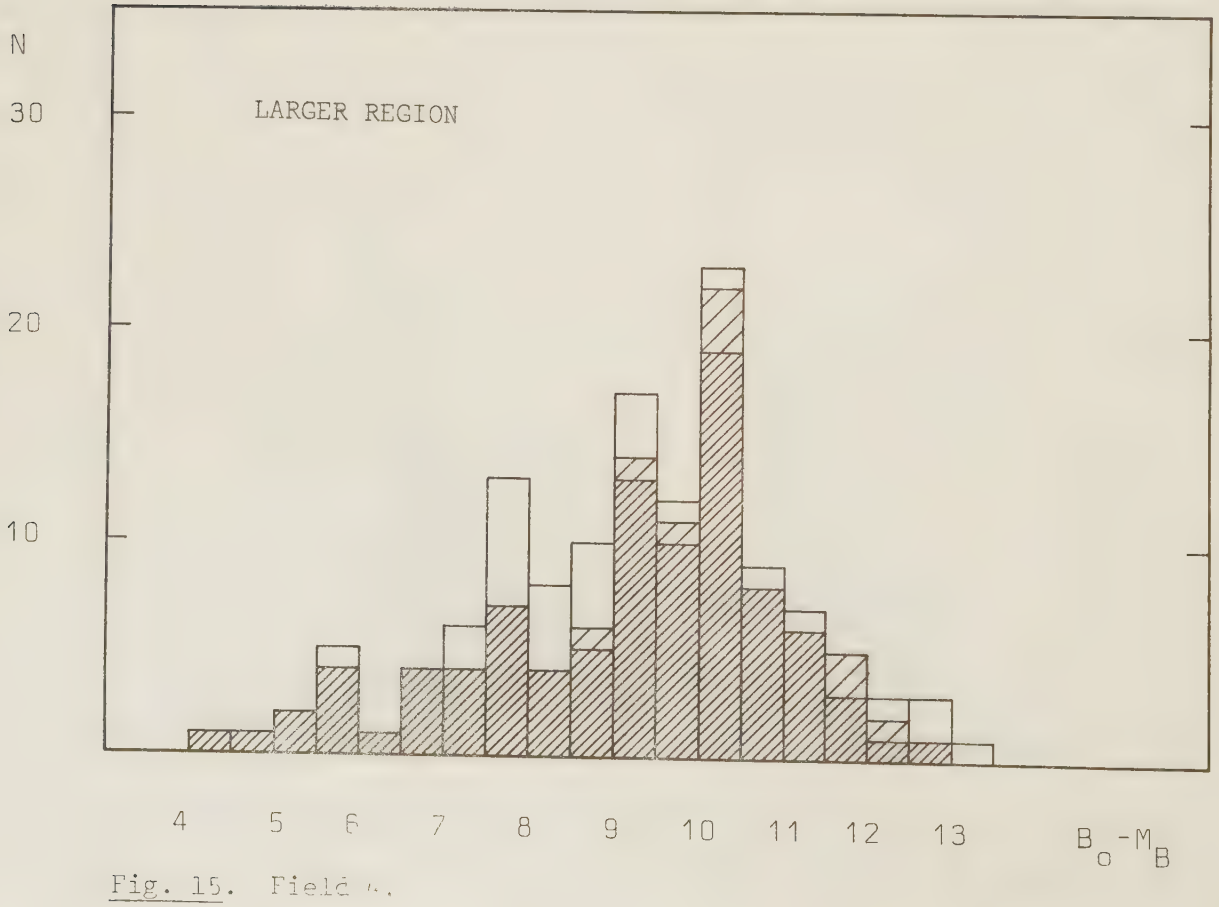
N
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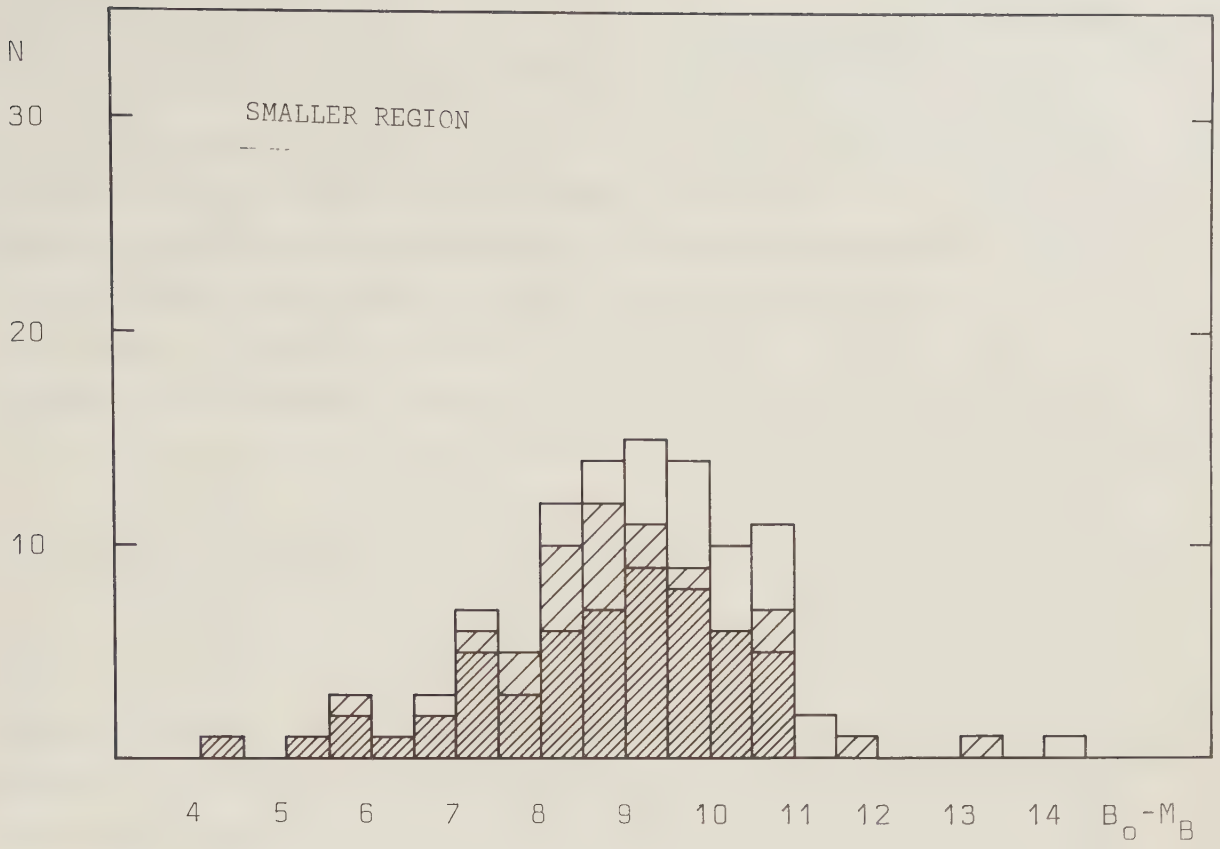
$B_o - M_B$

Fig. 15. Field ..



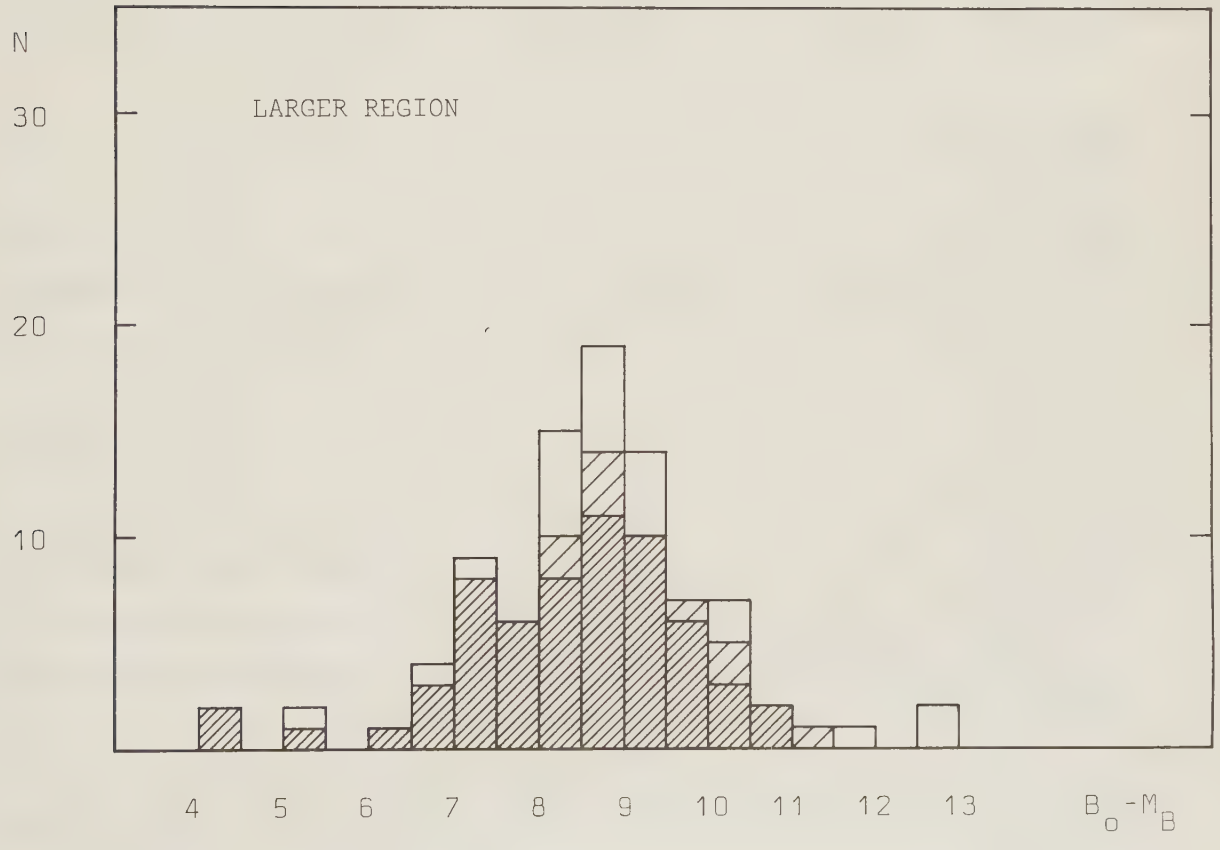


Fig. 16. Field 5.

3.3 A study of some earlier known or suspected clusters

Some earlier known or suspected clusters have been investigated. Five of them are situated in field 1: Trumpler 18, NGC 3590, Hogg 10, Hogg 11 and Hogg 12. They have previously been studied by Moffat and Vogt (1975). The other five clusters treated in this section have been proposed by Lodén (1971 and 1973b) who connects two of them with Ruprecht 94 (Lodén nos. 421 and 422). The results for all the clusters discussed here (exception: Hogg 10-12) are gathered in Table 16.

In our investigation, stars within the cluster regions have been carefully compared with regard to their colour excesses and distance moduli, starting with the stars previously suggested as members by the various authors. Allowing for the possibility that some of the stars may be somewhat evolved, those stars that fit the cluster sequences reasonably well in the colour-magnitude and two-colour diagrams have been accepted as members of the actual cluster. Accordingly, a few of the stars proposed as members by the other authors have been rejected, since they deviate too much from the accepted sequences in one or more of these diagrams. All stellar numbers given below refer to the Main Catalogue in the present work.

Field 1

Trumpler 18

All 14 stars suggested as members by Moffat and Vogt (1975) have been accepted as members (nos. 86, 93, 107, 121, 132, 140, 146, 162, 168, 171, 173, 177, 184 and 221). In addition, 37 stars are here proposed as members (nos. 67, 71, 72, 75, 94, 96, 105, 111, 114, 116, 117, 125, 126, 127, 133, 135, 137, 142, 147, 153, 156, 157, 160, 163, 167, 169, 172, 174, 175, 211, 228, 240, 247, 248, 265, 282 and 298) and 4 as possible members (nos. 95, 180, 204 and 218). One of the latter stars, 95, is the cepheid GH Car, which has a period of $5^{d}.72557$ according to Kukarkin et al. (1969). This period corresponds to M_V=-3.6 using the equations given by Beyer (1965).

The distance of Tr 18 may be determined from faint main sequence members, which should be unevolved. From 32 stars with V>$12^{m}.00$ we obtain a mean value of V-M_V=$12^{m}.16$ $\pm 0^{m}.30$ (s.d.). The distance may also be determined

with the aid of the evolution-deviation diagram, in which $V-M_V$ is plotted versus V (Johnson 1960). The best fit gives $V-M_V=12^m.34$. Finally, we may use the ZAMS curves in the colour magnitude diagrams (calibrations by Schmidt-Kaler 1965) after correction for the colour excess given below; we then get $V-M_V=11^m.90$. Thus, it seems as some of the luminous stars close to the main sequence are somewhat evolved (nos. 75, 133, 171 and 173). We accept the mean value $V-M_V=12^m.13$.

The age of Tr 18 has been calculated from the integrated colour corrected for the colour excess by means of Figure 7 in Sandage (1963). All 55 possible members give 1.0×10^7 years, while the earliest spectral type on the main sequence gives about 7×10^7 years (Sandage 1963). It is of interest to check if GH Car and star no. 218 have had time enough to evolve to their positions in the colour-magnitude diagram. According to models given by Iben (1966) a star with 5-9 solar masses requires $(2\text{-}7) \times 10^7$ years to reach the positions of the two stars. Using the tables of Schmidt-Kaler (1965) we find that the two stars under discussion are within the mass interval given above. Thus, it is quite possible that they are both members. The membership of GH Car would lead to $M_V=-2^m.9$ at the observations, which were performed $0^d.8$ before maximum according to the data given by Kukarkin et al. (1969). Although this result will lead to a smaller mass of GH Car, it is probably still within the mass interval given above.

There are some OB stars in the cluster region, but they are more distant, as already found by Moffat and Vogt. It is, however, hard to judge if they constitute a cluster (or association), since they are in a direction along the Carina spiral arm, where we expect a lot of early type stars to be concentrated (cf. discussion, chapter 5).

NGC 3590

Among the 21 stars suggested as members by Moffat and Vogt (1975), 7 have been observed here (nos. 312, 313, 315, 316, 321,322 and 327). They are all accepted as members, as they give clear sequences in the colour-magnitude and two-colour diagrams. Three more stars are here suggested as members (nos. 300, 303 and 308), as they fit well in the diagrams. They may appear somewhat displaced from the centre of the cluster, but are in fact only 2 pc from it, if the cluster is at a distance of 2 kpc.

From the 10 observed member stars the mean value of the colour excess has been determined, and, using this result, the ZAMS curves have been fitted to the sequences in the colour-magnitude diagrams. The apparent distance modulus, $V-M_V$, is then directly obtained. It appears that if the stars nos. 321 and 322 are members, their spectral types are more like B2 and B4 instead of B0 and B1 as given in the Main Catalogue.

Hogg 10, 11 and 12

Among the stars suggested as members of Hogg 10 and 11 (Moffat and Vogt 1975), only three stars have been observed (Hogg 10: nos. 88 and 98, Hogg 11: no. 187). They are all of early spectral type and possibly evolved. No additional stars in the vicinity of Hogg 10 and 11 seem to fit the cluster sequences in the colour-magnitude diagrams. By definition, a cluster ought to have more than two stars, and we can therefore neither confirm nor reject these two clusters, suggested to be real by Moffat and Vogt. However, the reddening in the directions of these possible clusters is in good agreement with the results by Moffat and Vogt. We obtain $E_{B-V}=0^m.48\pm0^m.03$ (s.d.) and $0^m.35$ for Hogg 10 and 11, respectively. Corresponding results by Moffat and Vogt are $0^m.46\pm0^m.02$ (s.d.) and $0^m.32\pm0^m.01$ (s.d.).

The stars in the region of Hogg 12 are dispersed all over the colour-magnitude and two-colour diagrams. From 9 apparently adjacent stars we get a standard deviation of $\pm0^m.19$ in the colour excess, and the stars are certainly at widely separated distances. Hogg 12 is definitely not a cluster. Moffat and Vogt came to the same conclusion.

Field 2

Lodén 421 and 422

According to Lodén (1973b), the two cluster candidates 421 and 422 are at the same distance and probably connected with Ruprecht 94. The colour excesses of the stars constituting 421 and 422 differ, however, and we prefer to separate the two cluster candidates, believing that Lodén 422 is a foreground cluster.

For Lodén 421 we have accepted as members the stars nos. 42, 43, 49, 50

and 51 as proposed by Lodén. Other stars in the cluster region have been carefully studied, and we suggest that the stars nos. 3, 7, 9, 15, 20, 22, 23, 28, 41, 61, 63, 67, 73, 78, 80, 81 and 93 are also members. Stars nos. 46 and 48, suggested as members by Lodén, are probably non-members.

Regarding Lodén 422, all stars proposed as members by Lodén have been accepted here (nos. 21, 30, 31 and 32). In addition, we suggest stars nos. 4, 17 and 37 to be members.

Field 3

Lodén 615

Three of the stars suggested by Lodén (1973b) as members do probably constitute a cluster (nos. 75, 82 and 83). The fourth, questioned by Lodén, is probably non-member (no. 79). Among the other stars in the cluster region, we suggest that the following stars are members: nos. 28, 32, 33, 35, 50, 54, 63, 66, 84, 86, 95, 96, 101, 114, 115 and 140. Two of these, nos. 33 and 35, are giants (cf. Table 12). There is an indication of two cluster sequences in the V,U-B diagram (see Figure 21) suggesting that the stars nos. 75, 82, 83, 96 and 140 may be a separate cluster with $V-M_V = 11^m.39 \pm 0^m.22$ (s.d., from individual distance moduli) and $E_{B-V} = 0^m.34 \pm 0^m.02$ (s.d.).

Field 4

Lodén 807

Five of the stars suggested by Lodén (1973b) as members are here accepted as members (nos. 10, 14, 23, 28 and 38). The remaining three stars proposed by him as members are probably non-members (nos. 5, 24 and 30). We suggest that, in addition, the stars nos. 3, 6, 7, 12 and 33 are members.

Lodén 822-24

Five of the stars suggested by Lodén (1971) as members are here accepted as members (nos. 121, 126, 143, 148 and 149). In addition, the stars nos. 118, 120, 145, 147 and 156 are probably members. The star no. 144, proposed as a member by Lodén, is probably non-member.

3.4 A possible, earlier unknown cluster (Anon.) in Norma

In field 5, no clusters have been found earlier. However, the peaks of the frequency-distance modulus diagram (cf. Figure 16) suggests a concentration of stars at about $V_o-M_V=9^m$. Therefore, a number of stars has been investigated in the same manner as in the previous section. The following stars are suggested to constitute a cluster (or association): nos. 12, 19, 28, 33, 34, 35, 48, 54, 64, 66, 76, 91, 92, 104, 105, 106, 113, 117, 118, 119, 120, 121, 137, 142, 144 and 145. Among these, stars nos. 28 and 118 are giants (cf. Table 12).

Using the same methods as above, we estimate the cluster to be about 2×10^8 years, and hence rather old.

3.5 A summary of the cluster study

In Table 16 the results of the various clusters are summarized. The $V-M_V$ values given there are mean values of the results obtained from individual $V-M_V$ determinations and from the ZAMS-fitting (using the calibrations by Schmidt-Kaler 1965) in the colour-magnitude diagrams, with the exceptions of Tr 18 and NGC 3590 (cf. section 3.3). As a rule the distance determinations by the two methods agree within $0^m.1$, but for NGC 3590 and Lodén 615 the difference is as much as $0^m.5$. All the time the ZAMS-fitting method gives a smaller distance. The explanation might be either misclassification (into earlier types), inclusion of evolved stars in the ZAMS-fitting procedure, inclusion of non-members or a combination of these. The standard deviation in $V-M_V$, when determined from individual values is in general $0^m.2$-$0^m.4$. Only for NGC 3590 and the Anonymous cluster in field 5 the standard deviation is larger, being $\pm1^m.14$ and $\pm0^m.67$ in these clusters.

For NGC 3590 such a high dispersion is serious, and we therefore preferred to use the ZAMS-fitting method in this case. As already pointed out, the differences for distance determinations of this cluster is most probably caused by misclassification of two of the stars (nos. 321 and 322). In fact, excluding these we obtain $V-M_V=13^m.17\pm0^m.73$, in good agreement with the adopted distance modulus (cf. Table 16).

Regarding the Anonymous cluster in field 5, the large standard deviation is of less importance, since the distance will not change palpably for such a nearby cluster.

The possible clusters Hogg 10 and 11 are not included in Table 16, as only three stars were observed in their regions.

From Table 16 it appears that the colour excesses obtained in the present work are systematically higher than what is obtained by the others. There is a number of various possible explanations of this effect. A systematic misclassification into earlier types, the excess of $0^m.03$ in B-V, or just selection effects. We use in most cases more stars, and may therefore have included more reddened members.

Table 16. Cluster data for the clusters investigated in the present work. As a comparison, results obtained by Moffat and Vogt (1975) and Lodén (1971 and 1973b) are given within parentheses. (N= number of accepted members, L=Lodén, MV=Moffat and Vogt).

Cluster	$\overline{E}_{B-V}$ m.v.±s.d.	$V-M_V$	r kpc	D pc	eSp	V_{tot}	$(B-V)_{tot}$	N	Notes
Tr 18	$0^m.34\pm0^m.05$	$12^m.13$	1.6	8	B4	$6^m.92$	$0^m.28$	55	
	(0.29±0.05	11.45	1.3	-	B5	--	--	14)	MV
NGC 3590	0.58±0.06	13.25	1.9	4	B1	7.92	0.30	10	
	(0.51±0.05	13.20	2.1	-	B1.5	--	--	21)	MV
L 421	0.40±0.05	13.60	2.9	20	B0	8.08	0.15	22	
	(0.30	--	2.8	-	--	--	--	**7**)	L, Ru 94
L 422	0.33±0.02	12.70	2.1	7	B2	8.88	0.11	7	
	(0.30	--	2.8	-	--	--	--	4)	L
L 615	0.32±0.04	11.4	1.2	10	B3	7.86	0.30	19	
	(0.24	--	1.3	-	--	--	--	4)	L
L 807	0.34±0.05	10.10	0.6	4	B8	8.59	0.28	10	
	(0.24	--	0.9	-	--	--	--	8)	L
L 822-24	0.34±0.04	12.50	1.9	8	B3	9.35	0.17	10	
	(--	--	2	-	--	--	--	6)	L
Anon.	0.17±0.07	9.36	0.6	3	B6	6.97	0.51	26	

The clusters appearing in the table are given in the Figures 17-24, together with the ZAMS-curves, corrected for the reddening - except for the two-colour diagrams. The horizontal bars on the ZAMS-curves indicate $M_V=0^m$, except for NGC 3590, where they mean $M_V=-1^m$.

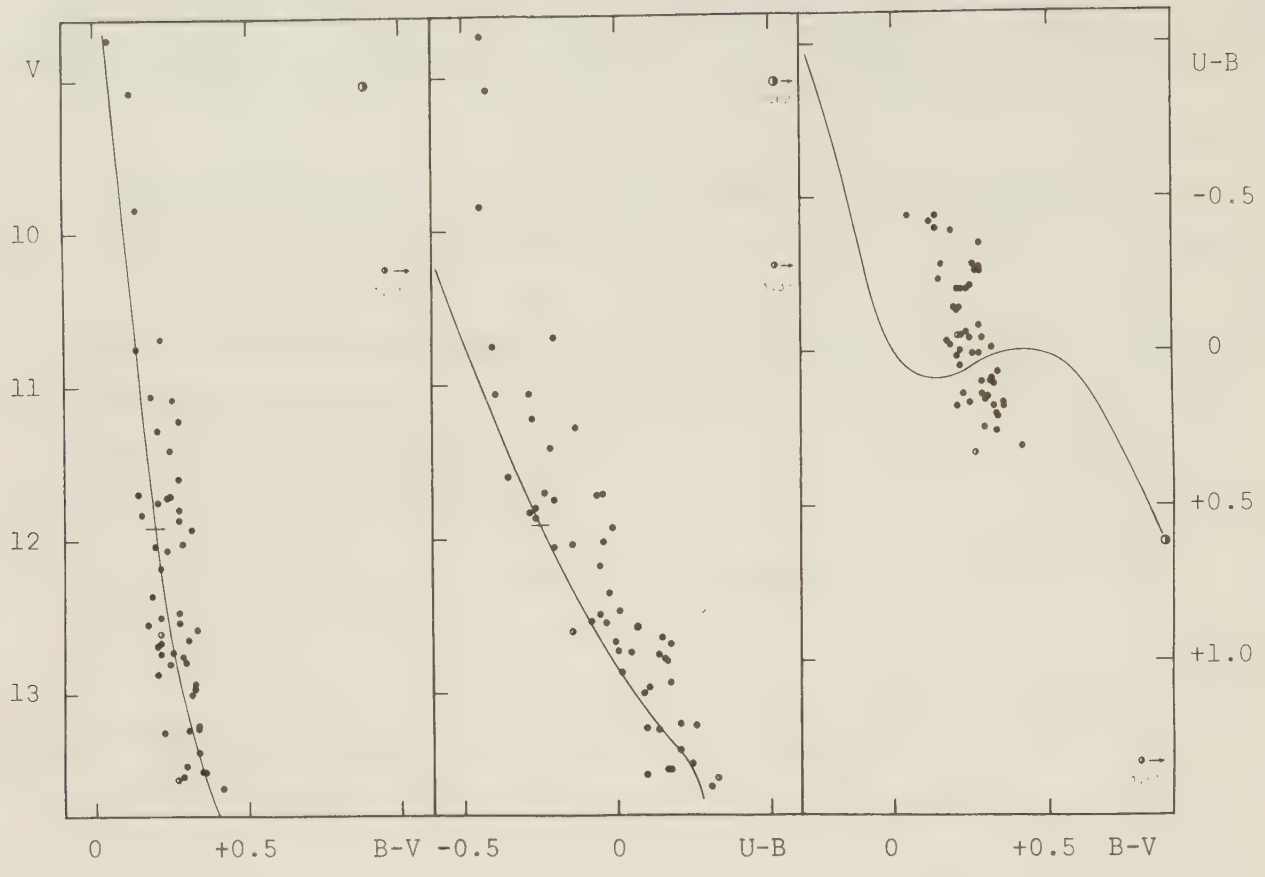


Fig. 17. Trumpler 18. Semi-filled circles: Possible members (the large one=GH Car). The horizontal bars on the ZAMS-curves indicate M_V=0.

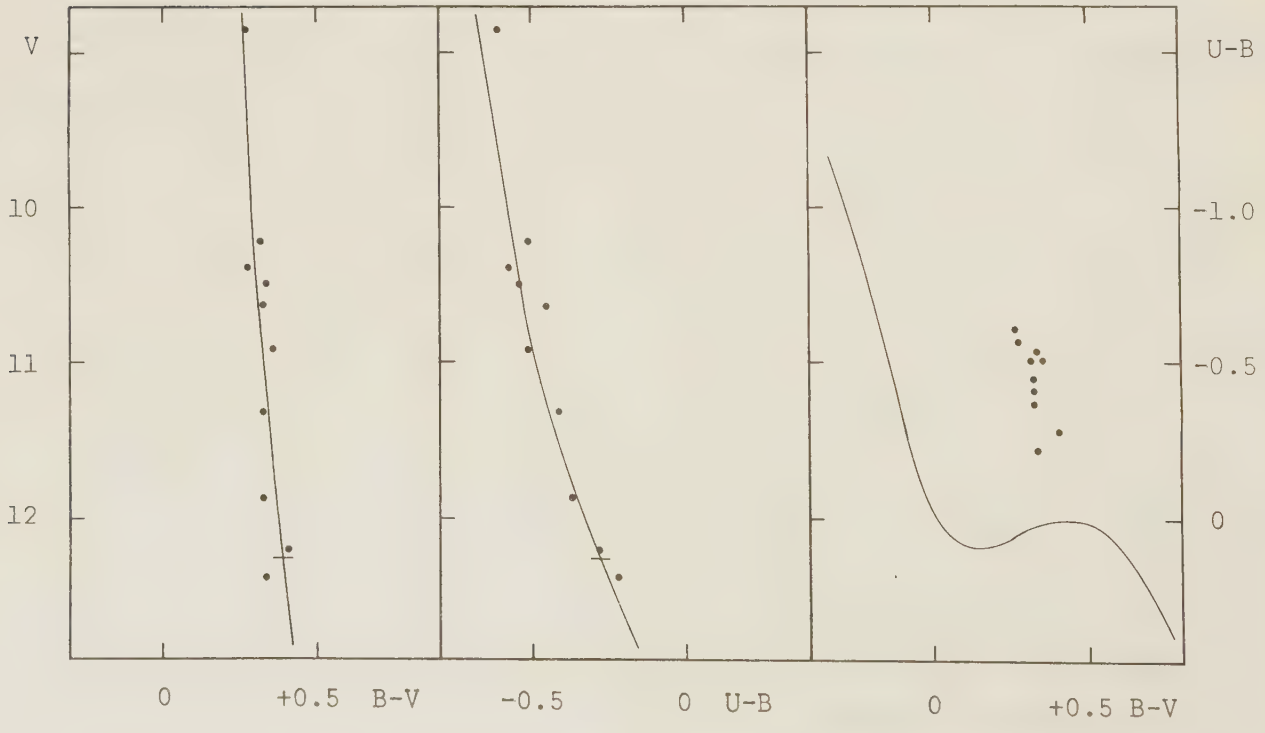


Fig. 18. NGC 3590. The horizontal bars on the ZAMS-curves indicate M_V=-1.

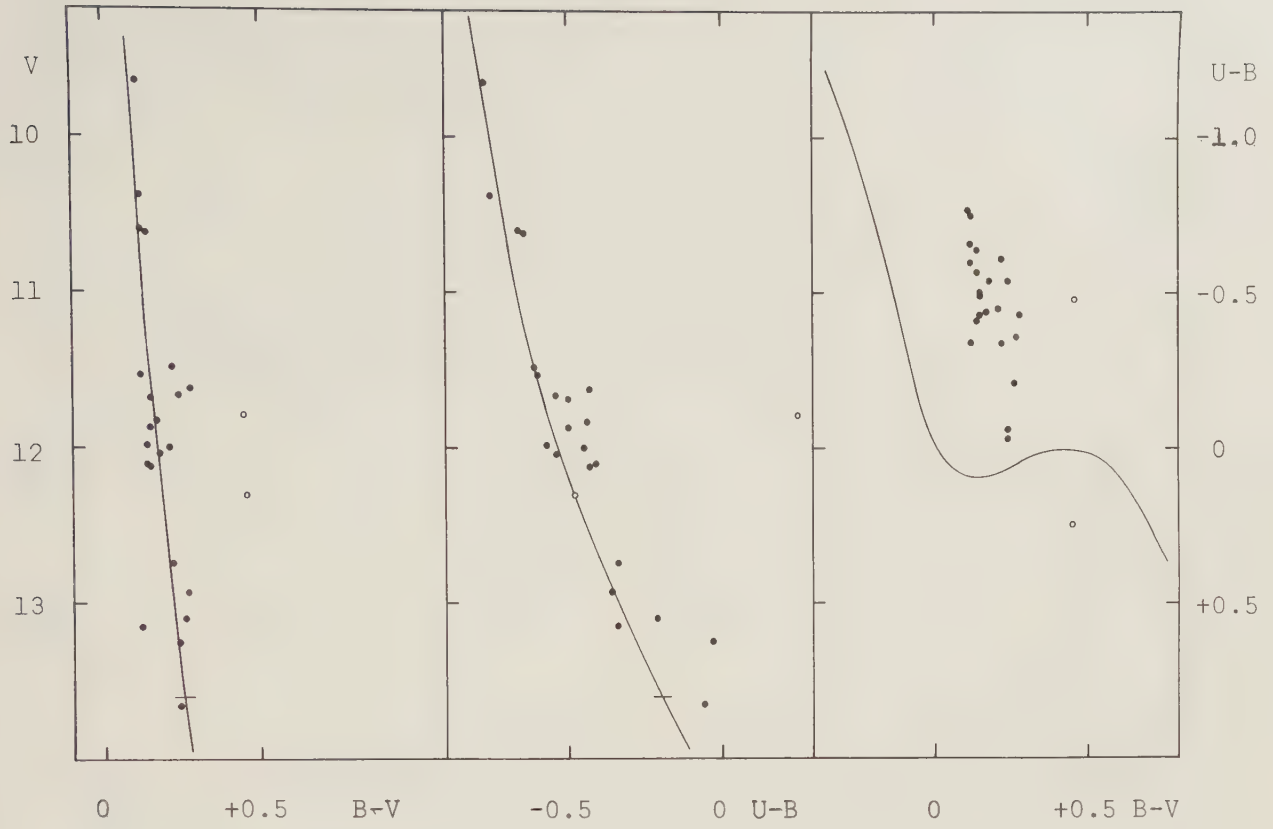


Fig. 19. Lodén 421. Open circles are probably non-members. The horizontal bars on the ZAMS-curves indicate $M_V=0$.

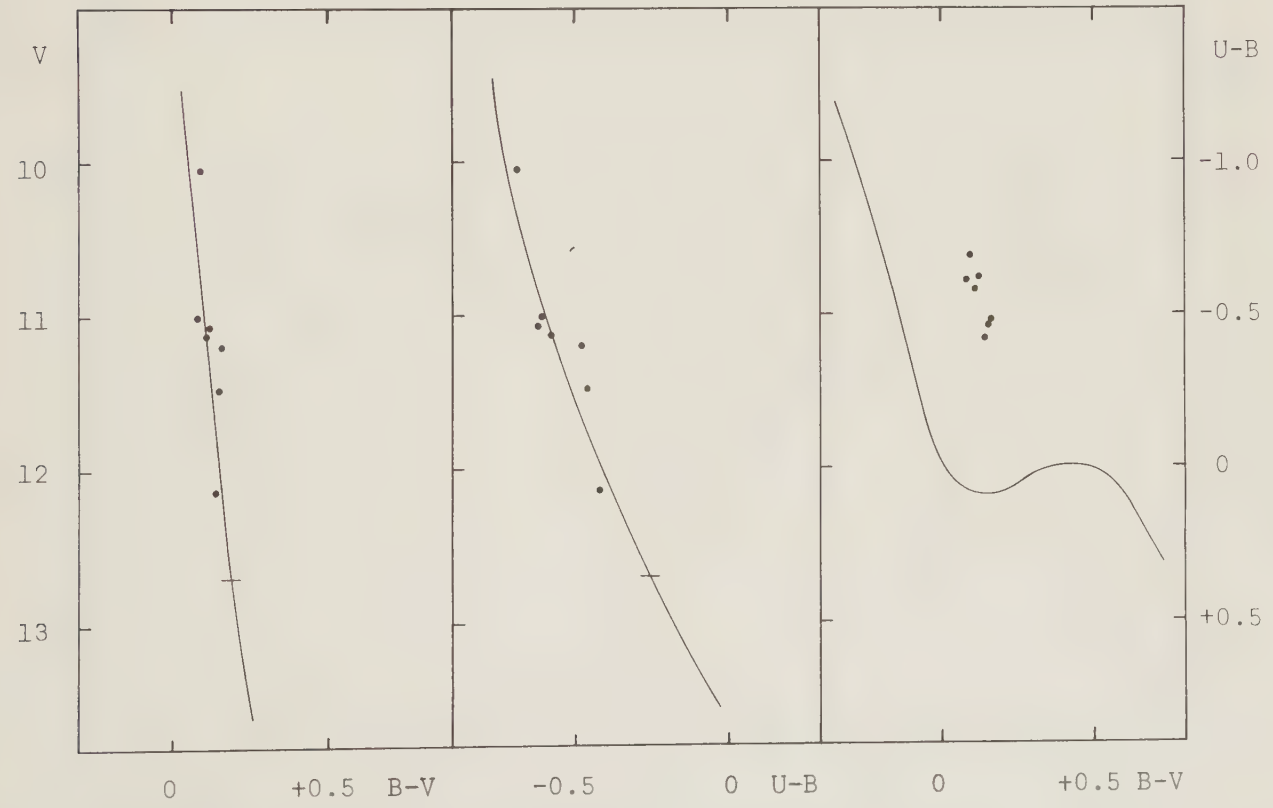


Fig. 20. Lodén 422. The horizontal bars on the ZAMS-curves indicate $M_V=0$.

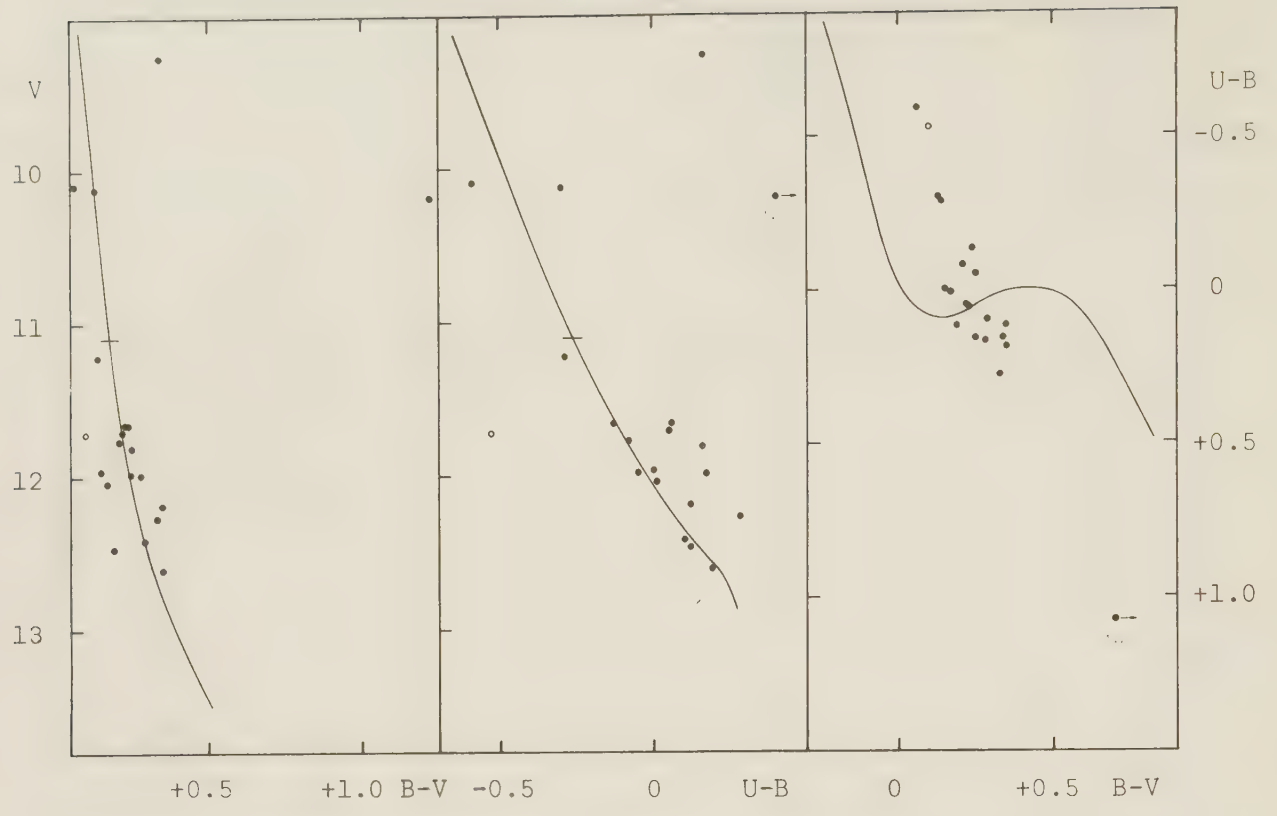


Fig. 21. Lodén 615. Open circle is probably non-member. The horizontal bars on the ZAMS-curves indicate $M_V=0$.

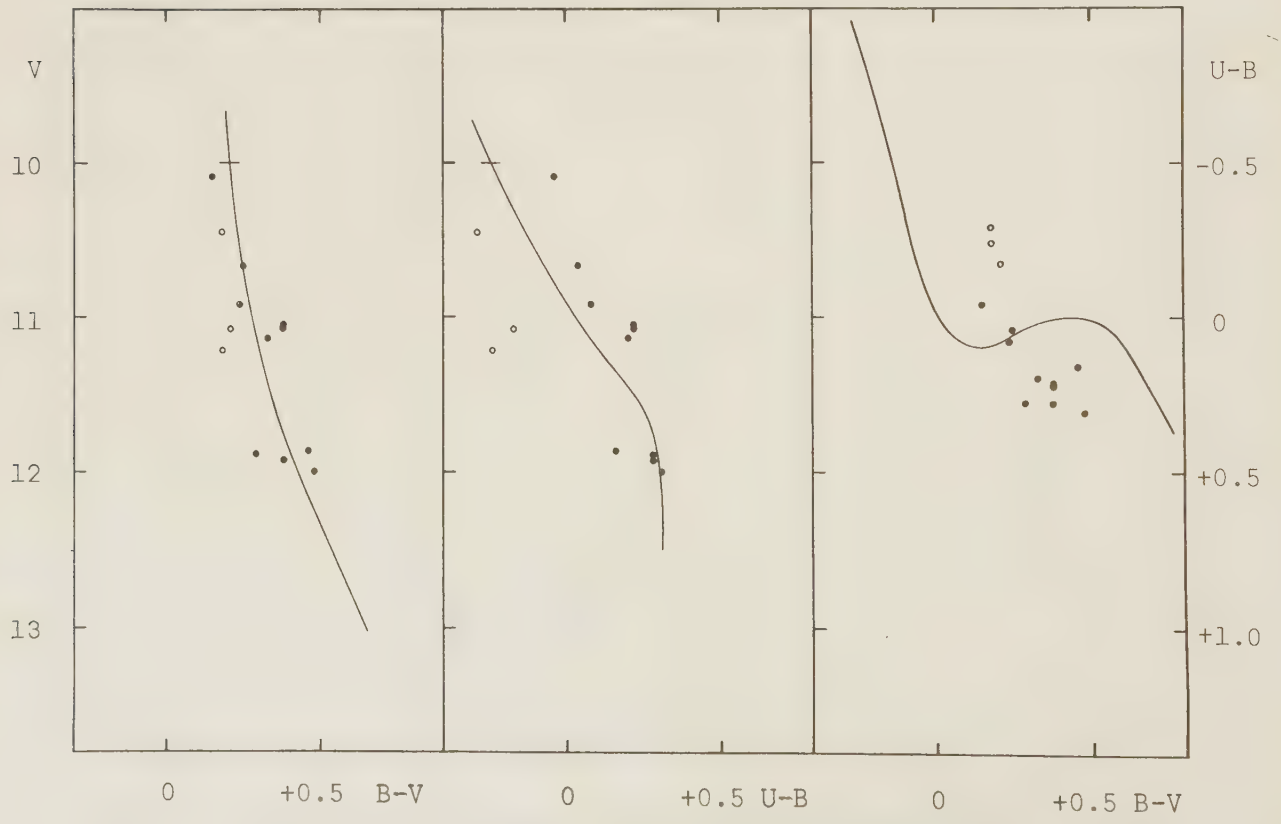


Fig. 22. Lodén 807. Open circles are probably non-members. The horizontal bars on the ZAMS-curves indicate $M_V=0$.

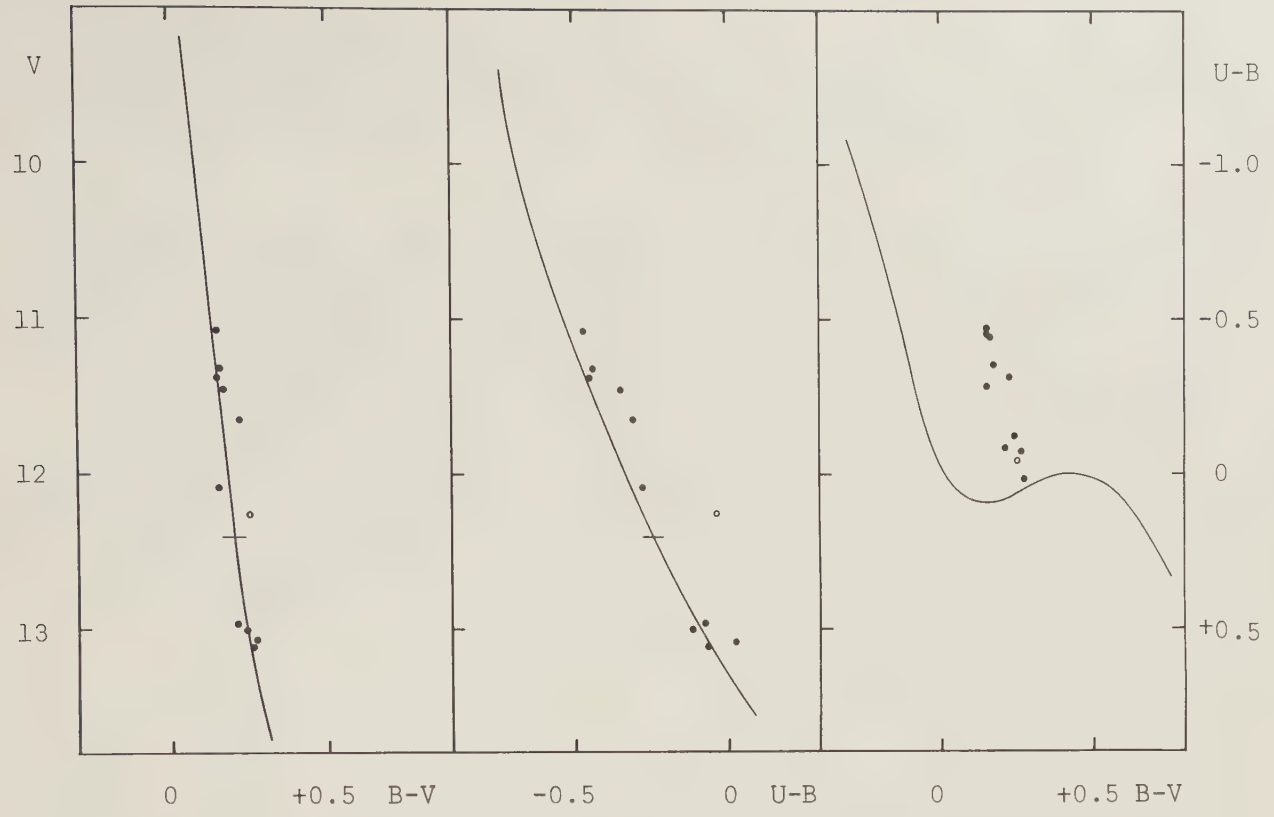


Fig. 23. Lodén 822-24. Open circle is probably non-member. The horizontal bars on the ZAMS-curves indicate M_V=0.

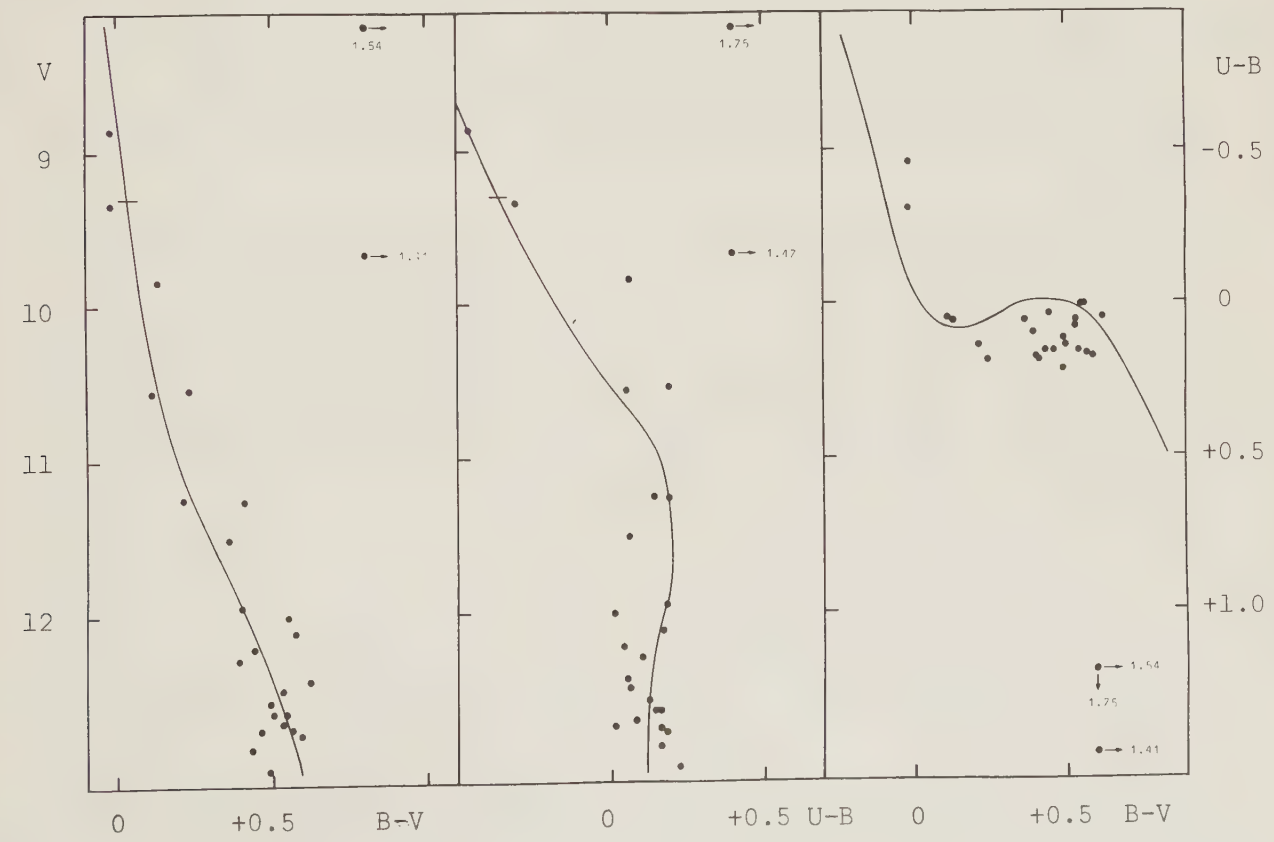


Fig. 24. Anonymous. A possible cluster in field 5. The horizontal bars on the ZAMS-curves indicate M_V=0.

4. A COMPARISON BETWEEN RANDOMLY DISTRIBUTED FICTITIOUS STARS AND THE OBSERVED STELLAR DISTRIBUTION

In the previous chapter we have studied a number of clusters. One of these, Anonymous in field 5, was found by looking at the distribution of stars in various intervals of the true distance modulus. In this connection it is of interest to investigate if randomly distributed stars may produce groupings at certain distances. Therefore, we have developed a simple data-programme generating fictitious stars at "random" positions and compared the resulting distribution with the observed one. The procedure is described in full detail in Appendix A.

4.1 The luminosity function

Starting with the luminosity function by van Rhijn (1936), assuming that $\Phi(M_{pg})=\Phi(M_B)$, we have distributed the fictitious stars in the way described in Appendix A. The accepted fictitious stars have been counted in various luminosity groups, down to $B=12\overset{m}{.}2$ and $11\overset{m}{.}3$ in the smaller and larger regions, respectively. The resulting numbers of expected stars are given in Table 17 together with the numbers of stars actually observed. We also give the van Rhijn's luminosity function in this table. The disagreement between the numbers of observed stars (col. 6 and 10) and the numbers of expected stars (col. 4 and 8) is striking.

It does not change essentially by "correcting" the spectral types in the Main Catalogue into "Michigan types" by means of Table 13. The differences are just moved to another luminosity group (cf. col. 7 and 11). If we regard the M_B groups as being M_{pg} groups and change the B_C magnitude into $m_{pg}=B_C-0\overset{m}{.}1$ (according to Lamla 1965) the numbers of stars obtained by using the luminosity function by van Rhijn will diminish (!), but only slightly (about 15 %).

Possible explanations of the disagreement may be that the colour excesses used in the procedure are too high, or that there are local deviations from the van Rhijn's luminosity function. We must not forget that we are using it over a long distance interval, covering both interarm regions and spiral arm regions - according to the picture by Humphreys (1976) - where quite different populations of stars may be expected. If the colour excess is smaller by $0\overset{m}{.}1$, we obtain a factor of 2 more

stars from the van Rhijn luminosity function. Regarding the local variations, we have already noted that most of the luminous stars come from field 1 while the excess of A-F stars comes from field 5.

We have modified the van Rhijn luminosity function, in order to see how much we must increase the stellar densities in various luminosity groups to get a better agreement with the observations (see Table 17, col. 3, 5 and 9). A continued modification would lead to a still better agreement, especially if the reddening in each field separately was used (cf. Figure 10). However, this is a minor problem compared to for example the uncertainties in the spectral classification, distance determination, or the local deviations from the luminosity function, and we considered it unnecessary to continue the modification in this context. Both luminosity functions have been used in the study of the stellar distribution according to distance modulus.

Table 17. A comparison of observed stellar frequences and frequences obtained from the random distribution of fictitious stars out to 4 kpc, utilizing the luminosity function by van Rhijn (1936) - the original and a modified. All fields are joined together. (KJ=spectral type according to the Main Catalogue, Mich=spectral type "corrected" into "Michigan types", Mod.= modified.)

	Luminosity function used (stars/1000 pc^3)		Resulting apparent stellar frequences, observed or expected.							
			Smaller regions				Larger regions			
M_B	Rhijn	Modified	Rhijn	Mod.	Observed KJ	Observed Mich	Rhijn	Mod.	Observed KJ	Observed Mich
-6	1.3×10^{-5}	1.0×10^{-4}	0	0	1	1	0	1	7	7
-5	1.2×10^{-4}	1.0×10^{-3}	1	4	9	3	1	11	17	7
-4	4.5×10^{-4}	8.0×10^{-4}	1	4	2	6	4	15	14	6
-3	1.8×10^{-3}	2.0×10^{-3}	10	11	7	7	14	24	18	26
-2	5.6×10^{-3}	1.0×10^{-2}	16	37	24	24	14	21	30	40
-1	1.2×10^{-2}	4.0×10^{-2}	5	19	31	23	5	21	29	25
0	4.8×10^{-2}	2.5×10^{-1}	6	47	29	12	10	51	36	9
1	2.2×10^{-1}	2.0×10^{-1}	8	16	7	31	12	12	11	40
2	5.9×10^{-1}	3.5	5	47	27	30	3	42	44	49
3	7.2×10^{-1}	(4.0)	1	14	10	19	0	(10)+/	7	13
4	1.55	(20.0)	0	12	11	7	0	(10)	6	3
5	2.24	(25.0)	0	1	5	1	0	-	2	0
6	3.09	(30.0)	0	0	1	1	0	-	1	1
7	3.39	(30.0)	0	0	1	1	0	-	1	1

+/ In some of the larger field regions the fictitious stars with M_B=3 and 4 are incomplete and those fainter were not distributed because of the great number of stars (150 000). Therefore the modified luminosity function should not be taken seriously for these groups.

4.2 The distribution of stars according to true distance modulus

The observed distribution according to the true distance modulus has been presented earlier (Figures 12-16), but here we put the smaller and larger regions together in each field in order to increase the number of stars. This means that apparently bright stars are counted twice. The resulting percentual distribution is given in Figure 25 for field 2.

The fictitious stars, obtained by means of the luminosity functions given in Table 17 and the procedure described in Appendix A, have been treated in the same way as the observed ones in all respects.

Our major problem in the random distribution of fictitious stars was the large interval of B_C-B_L. If $B_C-B_L=0$, the problem would disappear and we could accept all stars within the space cone down to the limiting magnitude, and thus eliminate one of the uncertainties. Two different methods of selecting fictitious stars in the apparent B magnitude interval B_C-B_L (cf. Table 1) were used. They are described in Appendix B.

As an example of the resulting expected distribution, we give in Figure 25 the one obtained for field 2 - together with the observed one - using the luminosity function by van Rhijn. The distribution of fictitious stars is similar in the other fields. The difference between the observed stars and the fictitious ones is pronounced. Probably this is due to the fact that we have a number of clusters and other groupings in the observed material. The decline in the observed distribution may be due to incompleteness of the material for faint B magnitudes, but if so, it is hard to explain why the fictitious stars do not show a similar effect. Possibly it could be caused by a real density maximum in the observed distribution (see discussion, chapter 5).

In order to check if the distribution of the fictitious stars is sensitive to the choice of starting number, when generating the random numbers in the procedure described in Appendix A, we have performed two independent runs for the field 2, using the same parameters and luminosity function (here: the modified version, cf. Table 17). The result is shown in Figure 26. It appears from this figure that the differences are big enough that we should be cautious and preferably not use frequency versus distance modulus diagrams to reveal star clusterings, if they are not outstandingly rich.

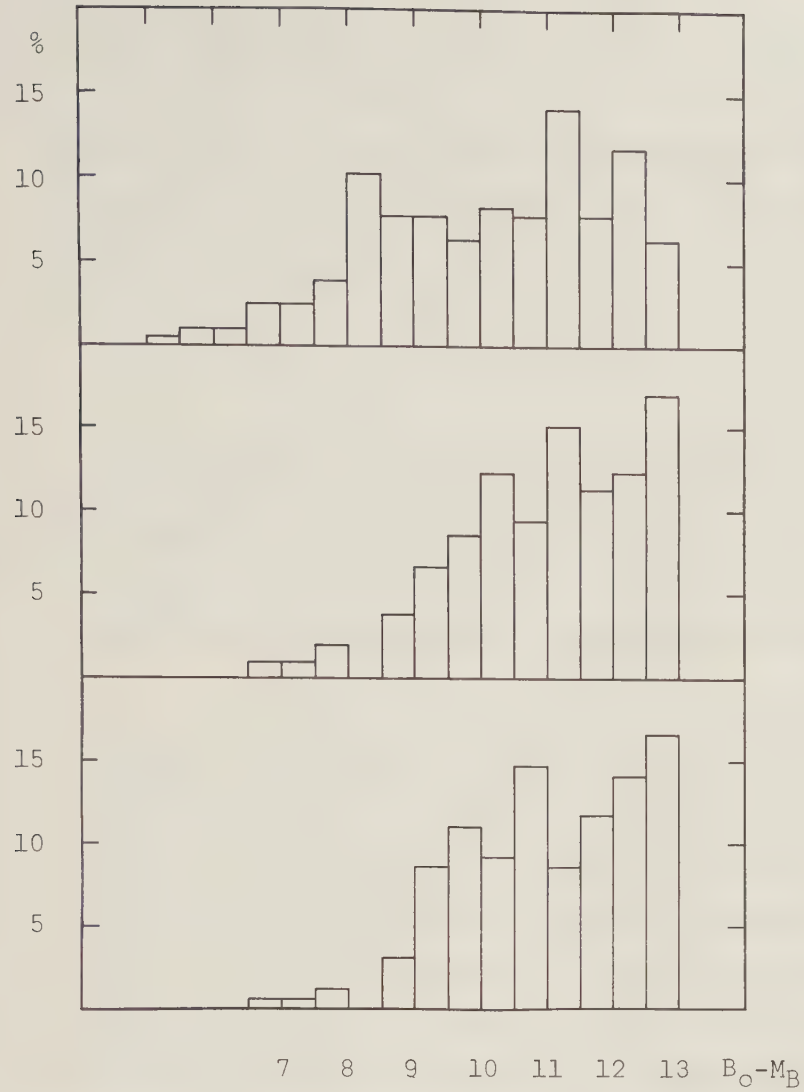


Fig. 25. Field 2.

Relative numbers of stars according to true distance modulus.

Above: Observed distribution.
Middle: Expected distribution, method 1.
Below: Expected distribution, method 2.

The van Rhijn luminosity function was used.

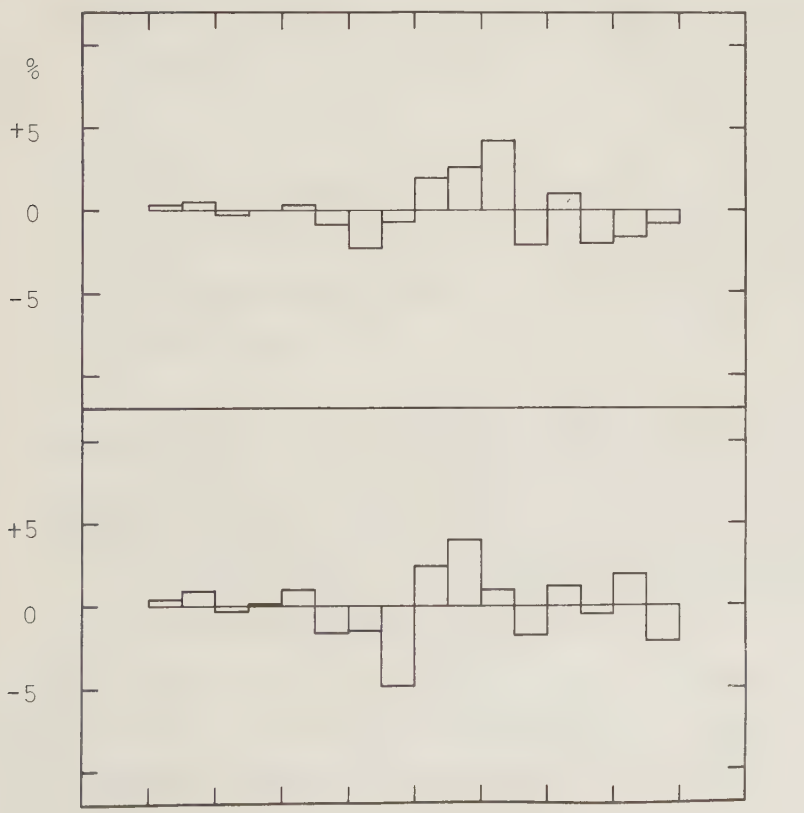


Fig. 26. Field 2.

Comparison between two different runs using the same parameters and luminosity function (modified) but with different starting number when generating random numbers.

Above: Method 1.
Below: Method 2.

5. DISCUSSION

In this chapter we will briefly discuss the results presented in the previous chapters, and compare them with results obtained by other observers.

5.1 The colour excess

The material does not allow any determination of the colour excess within 60 pc from the Sun. Such a determination has, however, been performed by Strömgren (1962) who finds that the reddening is practically zero out to about 90 pc. This result is in good agreement with our result for the very few stars observed in the distance modulus interval 4^m-5^m (cf. Figure 10).

The most puzzling feature of the colour excess further out is that most of the reddening occurs within about 0.8 kpc from the Sun, at least in the regions of Carina, Crux and Centaurus (fields 2-4). Accordingly, there is more dust in the interarm region than within the Carina spiral arm in these directions (cf. Figure 27). Certainly, Lynds (1970) has found, from studies of external galaxies, that the dust is concentrated to the inner edges of the spiral arms, but here it seems to extend more than half the way to the Carina arm. In Norma (field 5) the reddening increases all the way out to at least 1.5 kpc and possibly beyond, according to results by Drilling (1968), who obtained $E_{B-V}=0^m.9$ at a distance of 4 kpc. Extrapolating our reddening in this area (cf. Figure 10) we would expect $E_{B-V}=1^m.1$ at this distance. However, according to Westerlund (1969), the reddening in Norma ($l=330^\circ$, $b=+2^\circ$) has reached a value of $E_{B-V}=0^m.8$-$1^m.2$ already within 1 kpc from the Sun, with almost no additional reddening beyond this distance (out to about 4 kpc).

The amount of reddening, as well as its relation to distance and galactic position is compatible with results obtained by Deutschman et al. (1976). Thus, they find a patchy reddening in the direction of Carina (our field 1). In the directions of Carina, Crux and Centaurus (our fields 2-4) they find the interarm reddening discussed above, followed by an almost transparent space. However, they obtain less reddening out to 1 kpc followed by a rather steep increase to an almost constant value of $E_{B-V}=0^m.4$ in Centaurus (our field 4). This has not been confirmed by

our observations, possibly because our field is small and local differences may be important. Our results on the reddening are also confirmed by Lucke (1978) and Lodén and Sundman (1972).

Although we observe down to about the same limiting magnitude in the fields 2, 4 and 5 (cf. Figure 7), we have very few distant objects in the field 4 and almost none in field 5. Therefore, the behaviour of the reddening is uncertain beyond about 2 kpc in field 4 and 1.5 kpc in field 5. It would thus be very interesting to investigate these fields down to fainter limiting magnitudes, in order to see if the reddening ceases or increases beyond these distances.

5.2 The distribution of the stars according to true distance modulus

Most of the clusters are hidden in the distribution shown in the Figures 12-16, but Trumpler 18 (field 1) and Anonymous (field 5) are probably responsible for parts of the peaks seen in Figures 12 and 16, respectively. The peaks may also to some extent be caused by the incompleteness of the material at fainter magnitudes. However, there is a shift of the peaks in the respect that they appear closer to the Sun at greater galactic longitudes. Such an effect is not expected to occur, since the limiting magnitudes of the fields do not differ that much, except for field 1 and 3. The phenomenon may possibly reflect the contribution by the Carina spiral arm, where larger stellar densities are expected.

The random distribution of fictitious stars (cf. Figure 25) supports our belief that the major cause of the peaks is not the incompleteness of the material, but rather the higher stellar densities at certain distances.

As already pointed out in chapter 4, the frequency versus distance modulus diagrams are not very useful for revealing smaller clusters or associations. The peaks in such diagrams should be convincingly above the frequencies of the surrounding distance modulus intervals to be reliable (cf. Figures 25 and 26).

5.3 The spiral structure

It is of great importance and interest to investigate how well the various pieces of information obtained above fit into a large scale structure in the solar neighbourhood. Therefore, we have drawn the features of the spiral structure given by Humphreys (1976) and added our results. This is shown in Figure 27.

The clusters fall nicely inside the Carina spiral arm with the two exceptions of Lodén 807 (field 4) and Anonymous (field 5), both rather old and hence no good spiral tracers. However, even young clusters are sometimes found between the Local and the Carina spiral arms (Fenkart and Binggeli 1979).

The luminous stars ($M_B<-3^m$) are outstandingly frequent in field 1 and rather frequent in field 2, strongly supporting that in these directions we are observing almost along the Carina spiral arm. There are also some luminous stars in the fields 3 and 4. As most of them are distant (cf. Figure 27), the "Centaurus spur" suggested by Humphreys may be real, but we would prefer to have more observations in the whole interval $l=290^\circ$-310° in order to see if distant stars are found only inside the "spur". No luminous stars have been found in field 5 (within 3 kpc). This lack of luminous stars in Norma - as well as the richness in A-F stars - has earlier been noticed by Schnur (1970), Drilling (1968) and Lodén and Sundman (1972). (Cf. also Table 15.)

Using the Michigan Catalogue (1975 and 1978), the supergiants (Ia-0 to Ib) and a few O- and WR-stars bright enough to appear in the Bright Star Catalogue, BSC (1964), have been selected in the galactic longitude interval 265°-345°, $|b|<4^\circ$. The distribution of these is given in Table 18. The total number of supergiants is unfortunately small (54), but it is nevertheless interesting to notice that most of them are concentrated in the intervals $l=285^\circ$-305° and $l=340^\circ$-345°, while there are very few in the intervals $l=265^\circ$-285° and $l=305^\circ$-340°. Disregarding the Ib supergiants, there is in fact none in the interval $l=315^\circ$-335°!

Most of the "BSC supergiants" discussed here are at a distance of about 1-3 kpc, but some of the luminosity class Ib are quite close to the Sun. Since we are covering a large interval of galactic longitude, we are

looking into a pretty large volume of the Carina spiral arm and should expect to find some supergiants, although we look almost perpendicularly to the spiral arm. Indeed we do, but only beyond 335°! Either there is a real lack of luminous stars, or the obscuration is so heavy in the interval 315°-335°, that the stars become too faint to appear in the BSC. It would therefore be of a great interest to search for spiral tracers with the aid of the Michigan Catalogue down to a fainter limiting magnitude.

The distribution of the stars according to distance modulus show peaks that may resemble the Carina spiral arm, since they are shifted towards smaller distance moduli as we go from l=290° to l=327° (cf. Figures 12-16).

The colour excess does not fit well to the spiral features outlined in Figure 27. The behaviour of the reddening in the fields indicate that the interstellar reddening is more complicated and occurs also in the interarm space.

Table 18. The distribution of "Bright Star Catalogue Supergiants" as classified in the Michigan Catalogue (1975 and 1978) according to galactic longitude ($|b|<4^\circ$). (N=number of stars.)

	N		N		N
l=265°-270°	2	l=295°-300°	7	l=320°-325°	1
270°-275°	2	300°-305°	5	325°-330°	1
275°-280°	1	305°-310°	1	330°-335°	0
280°-285°	2	310°-315°	1	335°-340°	3
285°-290°	10	315°-320°	2	340°-345°	10
290°-295°	6				

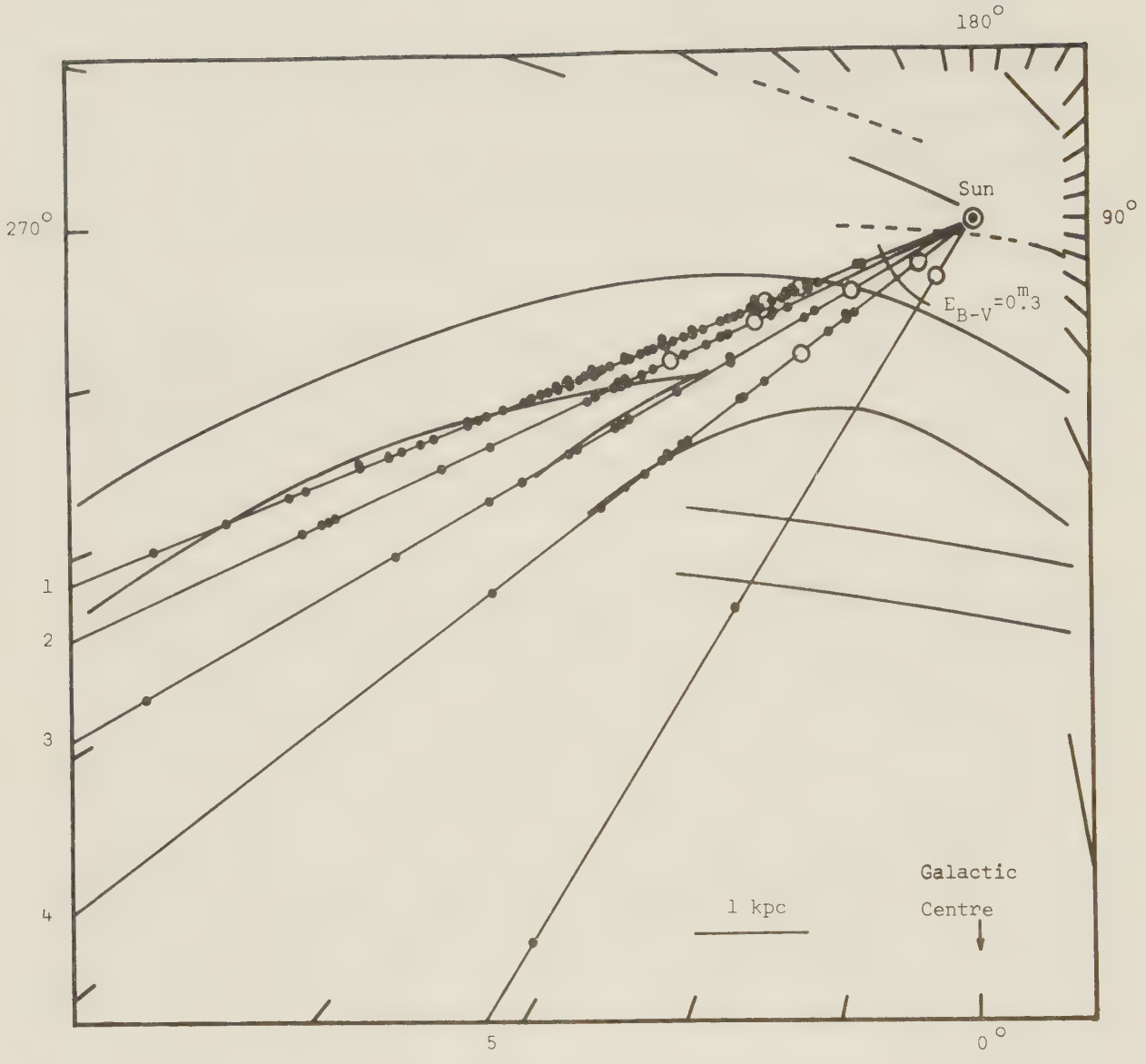


Fig. 27. The location of the fields (nos. 1-5, indicated along the axis), the clusters (open circles) and the luminous stars ($M_B<-3^m$, dots). The distance of 0.8 kpc, where $E_{B-V}=0^m.3$, is indicated by a curve. The spiral features shown are according to Humphreys (1976).

6. CONCLUSION

We have used the material given in the Main Catalogue to study the stellar distribution and interstellar reddening in the selected parts of the Milky Way. Also the luminosity function has been briefly discussed.

The reddening is probably negligable out to about 100 pc. The main contribution to the reddening occurs within about 0.8 kpc, where E_{B-V} is about $0^m.30$-$0^m.35$. However, in the fields 1 ($l=290^\circ$) and 5 ($l=328^\circ$) the reddening increases all the way, out to our distance limits, but in a inhomogenous manner at least in field 1. The behaviour of the reddening in the fields indicates that the interstellar reddening is more complicated and that there is dust in the interarm regions - as outlined by Humphreys.

The distribution of luminous stars strongly supports the idea that we are looking almost along the Carina spiral arm in field 1. The existence of the "Centaurus spur" suggested by Humphreys is uncertain, but may have some support in the distribution of luminous stars in the fields 3 and 4 as well as the possible rise of the colour excess in field 4 beyond 2 kpc (cf. Figure 10). There is a pronounced lack of luminous stars in field 5 (Norma) and an equally pronounced richness in A-F stars.

The peaks of maximum frequency are shifted towards the Sun with increasing galactic longitude. This is possibly caused by local deviations from the general luminosity function, and may also reflect the position of the Carina arm. If the latter interpretation is correct, the Carina arm may come as close to the Sun as 0,6 kpc in the direction of Norma. The peak of this field has, however, been interpreted as a cluster (or association).

The luminosity function by van Rhijn gives too few stars. This may be due to the fact that we are looking into small volumes but covering a large distance interval including both interarm space and spiral arm regions.

Regarding the clusters suggested by Lodén - and the Anonymous cluster suggested in the present work - the colour-magnitude and two-colour diagrams reveal typical cluster sequences, and they are probably real. Most of them have a position that agrees with the Carina spiral arm as outlined by Humphreys.

It would be interesting to investigate the colour excesses in the fields 4 and 5 out to greater distances than reached in the present work. This would demand a complete material down to fainter magnitudes, and the number of stars would increase appreciably and new spectral plates would have to be secured.

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The Main Catalogue

The columns in the Main Catalogue contain the following.

Column 1 Field number.

Column 2 Running number. These numbers are the same as those given on the finding charts. They are arranged after increasing right ascension.

Column 3 HD or CPD number. The identification has been made by drawing maps using the coordinates given in corresponding catalogue. Some HD or CPD stars are double. For these the HD or CPD number has been assigned to both candidates.

Column 4 V-magnitude.

Column 5 B-V colour.

Column 6 U-B colour. Stars with U fainter than $14^{m}.7$ are given with one decimal.

Column 7 Spectral type. Parentheses means that the spectral type given has been derived from observed colours.

Column 8 Possible giants or supergiants. Luminosity classes given are obtained by the method described in section 2.2.

Column 9 Number of UBV observations.

Column 10 Notes to the stars. We have used the following abbreviations:

- O = the spectrum is overexposed
- U = the spectrum is underexposed
- Ol = the overlap of the spectrum is serious
- Str = the spectral type of the star has been estimated only on spectral plates obtained at Mount Stromlo
- D = the photometry is uncertain because of too closeby neighbours
- B = unseparable double star. Both stars in the diafragm.
- uvby = the star has been observed in uvby.
- H = the star has been observed in Hβ.
- * = the star has got a remark at the end of the Main Catalogue.

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	1		12.21	0.51	0.14	F4		1	O1
1	2		12.28	0.37	-0.42	(B2)		1	
1	3		11.25	0.55	0.04	F0		1	
1	4		11.42	0.34	-0.54	B3		1	O1
1	5		11.27	0.39	0.31	A7		2	
1	6		12.64	0.30	-0.22	(B5)		1	
1	7	306086	9.49	0.30	-0.60	B2		1	
1	8		10.88	0.35	-0.52	B2		1	
1	9		11.77	0.37	0.17	A0		2	
1	10		12.86	0.83	0.29	G2		1	U
1	11	306085	9.75	0.34	-0.44	B1		2	
1	12		12.81	0.44	-0.24	(B3)		1	
1	13		11.79	0.31	-0.28	B6		1	
1	14		12.61	0.38	-0.35	B5		1	
1	15	306071	10.69	0.22	-0.47	B5		3	O1,D
1	16	306071	11.13	0.20	-0.34	B5		3	O1,D
1	17		12.20	0.45	0.12	A0		1	
1	18		12.63	0.44	-0.24	(B3)		1	
1	19		12.07	0.33	-0.42	B5		1	
1	20		12.77	0.42	0.16	(A8)		1	
1	21		12.48	0.74	-0.06	(B3)	B5 II	1	
1	22		11.77	0.36	-0.18	B8		1	
1	23		12.19	1.26	1.07	(K5)	G8 III	1	
1	24		12.28	0.15	-0.44	B5		1	O1
1	25	306070	10.30	0.44	-0.25	B2	B2 II	3	
1	26		12.72	0.48	-0.12	(B5)		1	
1	27		12.01	0.23	-0.16	B7		1	O1
1	28		11.24	0.32	0.21	B9		1	
1	29		12.52	0.46	0.13	A3		1	O1
1	30	306072	9.87	0.11	0.02	B9		2	
1	31		11.99	0.29	-0.45	B5		1	O1
1	32		11.84	0.47	0.20	A7		1	O1
1	33		12.03	0.57	0.04	F6		1	O1
1	34		11.25	0.25	-0.50	B3		1	
1	35		11.81	0.30	0.17	B9		1	
1	36	306073	10.21	0.17	-0.49	B3		1	
1	37	306059	9.43	0.12	-0.81	B0		1	
1	38		12.18	0.13	-0.12	(B8-9)		1	
1	39		10.94	1.76	2.0	(K5)	K5 III	1	B
1	40		11.26	0.84	0.41	F1	G0 III	4	O1
1	41		10.03	1.67	1.94	M2	M0 III	1	
1	42		11.56	0.29	-0.43	B2		1	uvby,H
1	43		12.32	0.43	-0.28	B6		1	
1	44	306084	11.13	0.11	0.08	A0		1	
1	45	306082	10.02	0.29	-0.54	B0		1	
1	46		12.65	0.28	0.13	B9		1	
1	47		11.57	0.31	-0.58	B0		1	uvby,H
1	48		12.47	0.53	0.08	A8		1	
1	49		12.08	1.61	1.6	(M5)	K3 III	1	
1	50	306099	8.74	0.18	-0.73	O8		1	uvby,H

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	51	97152	8.00	0.06	-0.66	W		1	O,uvby,H*
1	52		12.33	0.64	0.10	F5		1	
1	53		12.10	0.31	0.27	A0		2	
1	54	306055	11.33	0.34	0.10	A5		1	
1	55	306083	9.06	0.93	0.62	G5	G5 III	2	
1	56	306095	10.36	0.35	-0.54	O7		1	
1	57		11.49	0.44	0.19	F0		1	
1	58		12.80	0.59	0.18	(F2)		1	
1	59		12.50	0.59	0.14	(F4)		1	
1	60	306096	9.27	0.25	-0.68	B0		1	uvby,H
1	61	306054	10.72	0.19	-0.68	B2		1	
1	62	-60 2584	9.55	1.40	1.57	(K5)	K3 III	1	Ol
1	63	306081	9.69	0.40	-0.62	B1		1	Ol
1	64		11.53	0.20	-0.39	B7		1	
1	65	306098	8.58	1.16	0.99	K1	K1 III	2	uvby,H
1	66	-60 2588	10.49	0.29	-0.50	B2		1	uvby,H
1	67		13.25	0.23	0.14	A0		1	U
1	68	-60 2589	9.81	1.49	1.34	G8	K0 II	1	
1	69	306074	10.84	0.22	-0.56	B2		1	
1	70	306056	10.06	0.11	-0.80	B0		2	
1	71		12.69	0.21	0.18	A0		2	
1	72		12.87	0.21	0.02	B9		1	U
1	73	306080	10.36	0.30	-0.63	B1		1	
1	74		12.04	0.28	-0.28	B6		1	
1	75	97223	8.73	0.05	-0.44	B4		1	*
1	76		12.23	0.29	-0.43	(B3)		1	
1	77		11.79	0.43	0.11	A9		1	
1	78		13.01	0.31	-0.20	B8		1	U
1	79		11.82	0.84	0.43	K0		1	
1	80		12.54	0.64	0.47	A0	A7 III	2	
1	81		12.44	0.40	-0.28	B7		1	Ol
1	82	97237	8.43	1.21	1.06	K0	K1 III	2	uvby,H
1	83		11.96	0.62	0.12	(G2)		1	
1	84		12.67	0.17	-0.46	(B3)		1	
1	85		12.88	0.65	0.18	F6		1	U
1	86		13.54	0.29	0.10	(B9)		1	
1	87		12.98	0.37	0.10	B8		1	U*
1	88	97253	7.09	0.18	-0.79	B0	B0 II	2	O,uvby,H
1	89		11.90	0.26	0.15	B9		1	
1	90		11.27	0.98	0.74	(K2)	G5 III	2	
1	91		13.18	0.48	0.01	B7		1	U
1	92		12.25	0.36	0.01	B8-9		1	Ol
1	93		12.55	0.18	-0.03	B9		1	
1	94		12.02	0.29	-0.04	B9		1	
1	95	306077	9.04	0.88	0.62	F8	F8 II'	1	GH Car,Ceph
1	96	-60 2596	11.22	0.28	-0.27	B6		1	
1	97		12.53	0.48	-0.04	B5		1	Ol*
1	98	-59 3120	10.21	0.32	-0.26	B6	B5 III	2	
1	99		11.93	0.13	0.07	B9		2	
1	100		12.63	0.30	-0.25	B5		1	Ol

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	101	306079	11.12	0.15	0.07	A0		1	
1	102		12.06	0.47	0.05	B8		2	
1	103		13.04	0.34	0.07	(B9)		1	
1	104		12.61	0.71	0.19	(G2)		1	
1	105		12.06	0.24	-0.20	B8		1	
1	106		12.96	0.36	-0.30	(B3)		1	
1	107		13.24	0.32	0.10	A0		1	U
1	108		12.94	0.66	0.02	(G0)		1	
1	109		12.23	0.20	-0.21	(B7)		1	
1	110		12.55	1.46	1.2	(M1)	K0 III	1	
1	111		11.87	0.28	-0.26	B7		1	Ol
1	112	-59 3121	11.89	0.26	-0.25	B8		1	
1	113	97284	8.86	0.14	-0.76	O8		1	
1	114		11.93	0.32	-0.01	B8		1	
1	115		12.36	0.23	-0.20	B8		1	
1	116		13.51	0.36	0.17	(A0)		1	
1	117		12.76	0.29	0.14	B9		1	
1	118		12.42	0.75	0.37	(G8)		1	
1	119		12.28	1.26	1.09	(K5)	G8 III	1	
1	120		11.78	0.75	0.13	B9	A0 IB	1	
1	121		11.60	0.28	-0.35	B7		1	
1	122	306057	10.89	0.16	-0.05	B9		1	
1	123	306058	9.95	0.25	-0.72	O8		1	
1	124		13.11	0.32	-0.37	(B3)		1	
1	125		12.18	0.22	-0.05	B8		1	
1	126	-60 2603	11.28	0.21	-0.13	B8		1	
1	127	-60 2604	12.04	0.20	-0.14	B8		2	
1	128	-59 3130	11.50	0.66	0.14	F6		1	
1	129		12.61	0.21	0.16	B9		2	
1	130		12.50	0.34	-0.26	B6		1	
1	131		11.66	1.39	1.29	(M0)	K1 III	2	
1	132	-60 2607	11.71	0.25	-0.04	B9		1	
1	133	306075	10.69	0.22	-0.20	B8		1	*
1	134		12.76	0.31	-0.13	B7		1	U
1	135		12.79	0.30	0.16	(A0)		1	
1	136		12.42	0.25	-0.38	B7		3	Ol
1	137	-59 3133	11.83	0.16	-0.28	B6		1	
1	138	306078	10.43	0.19	-0.58	B2		2	
1	139		13.20	0.54	0.08	(F5)		1	
1	140	-59 3135	11.72	0.24	-0.06	B8-9		1	
1	141	-59 3136	11.62	0.20	-0.46	B0		1	
1	142	306173	11.06	0.19	-0.39	B4		1	Ol
1	143	306173	11.71	0.23	-0.65	B4		1	Ol
1	144	306076	9.32	1.02	0.67	G2	G5 III	1	uvby,H,Ol
1	145	-60 2609	11.62	0.48	0.24	F0	F0 III	1	
1	146	-60 2611	11.06	0.26	-0.28	(B5)		1	
1	147		13.01	0.32	0.09	(B9)		1	
1	148	-59 3139	11.19	0.14	0.08	A0		1	
1	149	-59 3141	11.06	0.19	-0.64	B2		1	
1	150		11.59	0.58	0.17	F6		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	151		12.35	0.39	0.19	A2		1	
1	152		12.85	0.33	-0.26	(B5)		1	
1	153		12.36	0.19	-0.02	B8		1	
1	154	-60 2612	11.40	0.26	-0.42	B5		2	
1	155	306097	8.91	0.67	-0.31	B1	B1 IA	3	
1	156	-59 3143	11.80	0.28	-0.26	B8		2	
1	157		12.73	0.26	0.01	(B9)		1	
1	158		12.61	0.61	-0.12	(B3)	B3 III	1	
1	159	-60 2617	11.82	0.28	-0.51	B5		1	Ol
1	160		12.94	0.33	0.18	(A0)		1	
1	161	-59 3145	11.67	0.45	0.10	A7		1	
1	162	-59 3146	11.41	0.25	-0.21	B7		1	
1	163		12.65	0.31	0.15	(A0)		1	
1	164		13.15	0.69	0.19	(G4)		1	
1	165		12.78	0.38	0.08	(B9)		1	
1	166		12.80	1.32	1.0	(K7)	G8 III	1	
1	167	-59 3148	11.70	0.15	-0.23	B7		3	
1	168	-59 3149	11.75	0.21	-0.20	B8		1	
1	169		12.97	0.33	0.11	(B9)		1	
1	170	-59 3150	11.08	0.31	-0.35	B5		2	
1	171	306174	9.84	0.14	-0.44	B4		1	uvby,H*
1	172		12.50	0.22	-0.05	B9		1	
1	173	-60 2619	9.08	0.12	-0.42	B4		1	uvby,H*
1	174		12.58	0.34	0.07	B9		1	
1	175		13.62	0.42	0.31	(A3)		1	
1	176		11.84	1.30	1.26	(K7)	K0 III	1	
1	177		12.47	0.28	0.01	B9		1	
1	178		12.95	0.39	-0.12	(B6)		1	
1	179		11.72	0.69	0.24	G5		1	Ol
1	180		12.61	0.22	-0.14	B8		1	
1	181		13.00	0.29	-0.37	(B3)		1	
1	182		12.00	0.24	-0.43	(B3)		1	
1	183		13.26	0.39	0.26	(A5)		1	
1	184	306175	12.54	0.28	-0.08	B8-9		1	
1	185	-59 3154	9.94	0.37	0.14	F0		1	Ol
1	186	-59 3155	10.36	0.09	-0.73	B0		1	Ol
1	187	97381	8.31	0.07	-0.70	B1		1	uvby,H
1	188		12.40	0.54	-0.23	B6		1	
1	189		13.07	0.51	-0.13	(B5)		1	
1	190	306182	11.90	0.57	0.01	(F8)		1	
1	191		11.81	1.33	1.14	(K7)	K0 III	1	
1	192		12.42	0.45	0.09	B8		1	D*
1	193		13.29	0.44	0.16	(F0)		1	
1	194		12.35	1.84	1.7	(M5)	K3 III	1	D
1	195		12.01	1.89	1.8	(M5)	K5 III	1	
1	196	-59 3159	10.45	0.15	-0.68	B1		1	
1	197	-59 3161	10.40	1.37	1.43	G5	K2 III	1	Ol
1	198		13.59	0.44	0.11	(F0)		1	
1	199	-59 3162	12.27	0.21	-0.48	B4		1	Ol
1	200	-59 3162	12.04	0.27	0.21	B8-9		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	201	-59 3163	11.63	0.70	0.20	F0	F5 III	1	
1	202		12.89	0.47	0.09	(F2)		1	
1	203	306176	10.12	0.11	0.03	B8		1	
1	204		13.56	0.27	0.33	(A1)		1	
1	205		12.16	0.29	-0.29	B7		1	
1	206	306189	11.25	0.11	-0.09	B9		1	
1	207	97400	7.79	0.13	-0.60	B1		1	uvby,H
1	208		11.60	1.13	0.89	(K3)	G8 III	1	
1	209	97399	8.45	0.05	-0.81	B1		1	uvby,H
1	210		12.85	0.21	-0.32	B2		1	U
1	211		13.38	0.34	0.21	(A0)		1	
1	212	306181	9.56	0.15	-0.70	B0		1	
1	213		12.66	0.68	-0.12	(B3)	B3 III	1	
1	214		13.69	0.48	0.20	(A8)		1	
1	215		13.24	0.31	-0.16	(B6)		1	
1	216	-59 3167	11.75	0.22	-0.01	B8		1	
1	217	-59 3168	11.13	0.22	-0.44	B5		1	
1	218		10.24	1.51	1.33	G5	G8 II	1	
1	219	306188	11.01	0.22	0.00	B9		1	
1	220		11.27	1.01	0.70	(K2)	G5 III	1	
1	221	306177	10.75	0.14	-0.40	B6		1	
1	222		13.25	0.53	0.30	(A7)		1	
1	223		12.14	0.44	-0.28	(B3)		1	
1	224		13.40	0.56	0.04	(F8)		1	
1	225		12.31	0.27	-0.38	B6		1	
1	226	-59 3169	11.18	0.35	0.17	A1		1	
1	227		13.29	0.37	-0.08	B5		1	U
1	228		12.74	0.22	0.05	(B9)		1	
1	229	97434	8.06	0.17	-0.79	O5		1	uvby,H
1	230		12.06	0.31	-0.44	(B2)		1	
1	231		11.91	0.60	0.03	(G0)		1	
1	232	306172	9.38	1.22	1.21	K2	K1 III	1	
1	233		12.67	0.53	0.10	B7		1	U
1	234		12.82	1.38	1.1	(K7)	G8 III	1	D
1	235		13.45	0.48	0.31	(A6)		1	D
1	236	-59 3173	11.71	0.21	-0.20	B8		1	
1	237	-59 3174	12.24	0.33	0.19	A5		1	
1	238		13.12	0.65	0.45	(A7)	A7 III	2	
1	239		12.50	0.60	-0.06	(B5)	B5 III	1	
1	240		13.51	0.36	0.18	(A0)		1	
1	241	-60 2633	10.42	1.18	1.10	G8	G8 III	1	
1	242		12.50	0.21	0.15	B9		1	
1	243		13.44	0.50	0.26	(A8)		1	
1	244		13.61	0.47	0.06	(B8)		1	
1	245		12.28	1.07	0.81	A7-8	G5 III	1	U
1	246		12.77	0.15	0.03	B9		1	
1	247		12.80	0.25	0.17	A0		1	U
1	248		12.67	0.22	0.00	B9		1	
1	249		12.67	0.65	0.12	F4		1	
1	250	-60 2636	10.97	1.33	1.24	K0	K1 III	2	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	251		12.41	0.29	-0.40	(B3)		1	
1	252		12.17	1.16	1.08	(K5)	K0 III	1	
1	253	306180	10.31	0.31	-0.56	B0		1	uvby,H
1	254		12.28	0.55	-0.36	(B1)		1	
1	255	-59 3179	11.17	0.22	-0.60	B0		1	
1	256		12.32	1.21	1.2	(K5)	K0 III	1	
1	257	-59 3181	11.81	0.23	-0.55	B2		1	
1	258		12.54	0.38	-0.06	B8		1	*
1	259		12.98	0.52	0.03	(F8)		1	
1	260		12.83	0.38	0.11	B8		1	U
1	261		12.22	0.11	-0.52	B2		1	
1	262		11.47	1.29	1.10	G8	K0 III	1	U
1	263		12.84	1.00	0.73	(K2)		1	
1	264		12.78	0.20	-0.42	B2		1	
1	265		13.21	0.34	0.21	A0		1	U
1	266	-60 2646	10.80	0.32	-0.55	B0		1	
1	267	-60 2647	10.32	0.22	-0.69	B2		1	uvby
1	268		12.91	0.27	-0.30	B6		1	U
1	269		12.23	0.30	-0.25	B8		1	Ol
1	270		12.09	0.57	0.14	F2		1	
1	271	306183	10.06	0.15	0.06	B9		2	uvby,H
1	272		13.14	0.34	0.12	(B9)		1	
1	273	-59 3182	10.41	0.92	0.64	A7	F0 IB	1	
1	274	-59 3183	11.54	0.28	-0.56	(B1)		1	
1	275		12.07	0.41	-0.20	(B5)		1	
1	276	-59 3184	9.85	1.86	1.97	K2	K1 IB	1	Ol
1	277	-59 3185	11.36	0.38	-0.43	B0		1	
1	278	-59 3186	12.22	0.14	-0.13	B9		1	
1	279	-59 3186	11.58	1.06	0.88	F0	G5 III	1	Ol
1	280		12.94	0.64	0.09	(G0)		1	
1	281	-59 3187	11.66	0.28	-0.45	B3		1	
1	282		13.47	0.30	0.25	(A1)		1	
1	283	306179	10.40	0.23	-0.66	B0		1	uvby,H
1	284	306178	10.59	0.24	0.14	B9		1	Ol
1	285		11.98	0.46	0.12	F2		1	
1	286	306178	11.76	0.51	0.10	F2		1	Ol
1	287	-60 2655	10.82	0.41	0.08	B8	B8 III	1	
1	288	-60 2656	10.68	1.32	1.14	(K5)	K0 III	1	
1	289		13.33	0.37	-0.08	(B7)		1	
1	290		12.95	0.67	0.19	(G2)		1	
1	291	306187	10.18	0.35	-0.48	B3		1	
1	292		12.01	0.29	-0.43	B5		2	
1	293	306184	10.70	0.28	-0.54	B1		3	D,Ol
1	294	306184	10.26	0.17	-0.60	B1		2	D,Ol
1	295		12.52	0.46	0.10	(F1)		1	
1	296		11.71	1.56	1.4	(M5)	K2 III	1	
1	297		12.01	0.58	-0.17	(B3)	B5 II	1	
1	298		13.22	0.34	0.26	A0		1	U
1	299	-59 3192	11.74	0.23	-0.35	B6		1	
1	300	97581	8.84	0.27	-0.61	B0		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
1	301		12.64	0.66	0.04	(G0)		1	
1	302		11.70	0.53	-0.30	(B2)	B2 III	3	
1	303	-60 2666	10.39	0.28	-0.57	B3		1	
1	304	-60 2667	11.15	0.23	-0.51	B3		1	
1	305	306166	9.17	1.55	1.85	K3	K3 III	1	
1	306		12.66	0.38	0.13	B6		1	
1	307		12.80	0.32	-0.08	(B7)		1	
1	308		12.38	0.34	-0.22	B6		1	
1	309	-60 2669	11.10	0.25	-0.48	B3		1	
1	310	-60 2670	11.47	0.38	0.17	B8		1	*
1	311	-60 2670	11.36	0.38	0.13	B8		1	*
1	312	-60 2671	10.22	0.32	-0.51	(B1)		1	
1	313		11.87	0.33	-0.37	B4		2	
1	314		12.63	0.66	0.03	(F8)		1	
1	315	-60 2673	10.49	0.34	-0.54	B2		1	
1	316	306185	11.32	0.33	-0.41	B4		3	
1	317	-59 3203	11.18	0.23	-0.61	B2		1	
1	318		12.15	0.19	-0.49	B4		1	
1	319		12.81	0.46	-0.24	(B3)		1	
1	320		12.04	0.28	0.05	B8		1	
1	321	306186	10.63	0.33	-0.45	B0		1	*
1	322		12.20	0.41	-0.28	B1		3	*
1	323		12.46	1.16	0.79	(K3)	G5 III	1	
1	324		11.34	1.09	0.81	(K3)	G5 III	1	
1	325	306171	9.65	0.18	-0.75	O8		1	
1	326		11.92	0.35	-0.34	B3		1	
1	327	-60 2680	10.92	0.36	-0.51	B1		1	
1	328		11.71	1.14	0.84	(K3)	G5 III	1	
1	329		11.85	0.73	0.17	(G5)		1	
1	330		12.07	0.36	0.20	B8		1	
1	331		12.35	0.54	0.06	F5		1	U
1	332		11.82	1.08	0.81	(K3)	G8 III	1	
1	333	306167	10.83	0.20	-0.14	B8		1	
1	334		12.51	0.64	0.11	(G2)		1	
1	335	-60 2686	11.74	0.30	0.14	A0		1	
1	336	-60 2692	11.66	0.60	0.07	F5		1	
1	337		11.21	0.43	0.20	A4		1	
1	338		12.84	0.32	0.15	A0		1	U
1	339		11.79	0.73	0.19	G2		1	
1	340		12.42	0.34	-0.29	B6		1	
1	341	97707	8.10	0.51	-0.41	B0	B0 IB	2	uvby,H

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
2	1		10.78	1.30	1.08	G6	K0 III	1	
2	2	308594	11.06	0.42	0.29	A0		1	
2	3		11.53	0.12	-0.60	B2		1	
2	4	308593	10.05	0.09	-0.69	B2		1	
2	5		11.57	1.56	1.43	K0	K2 III	1	U
2	6		12.04	0.17	-0.29	B8		1	
2	7	308592	10.62	0.14	-0.64	B1		1	
2	8		12.48	0.18	0.04	B9		1	
2	9		11.68	0.15	-0.50	B3		1	
2	10		12.45	0.18	0.04	B9		1	
2	11	308610	10.35	0.32	-0.45	B3		1	*
2	12	308609	10.73	0.37	0.24	A2		1	
2	13		12.21	0.37	0.31	A0		1	
2	14		12.16	0.31	0.16	B8		1	
2	15	308591	10.60	0.12	-0.66	B2		1	
2	16	308588	10.85	0.14	-0.47	B4		3	
2	17		12.14	0.14	-0.42	B6		2	
2	18		12.11	0.45	0.25	A3		1	
2	19	100098	8.54	0.26	0.27	B8	A0 III	3	uvby,H
2	20		12.12	0.15	-0.43	(B4)		2	
2	21	308595	11.01	0.08	-0.61	B3		1	
2	22		12.04	0.18	-0.54	B3		1	Ol
2	23		11.66	0.24	-0.54	B3		1	Ol
2	24		11.56	0.35	-0.41	B3		1	*
2	25		11.57	1.25	1.15	G2	G5 III	1	U
2	26	308611	11.35	0.31	-0.58	B0		1	
2	27	308590	10.48	1.33	1.17	K0	K0 III	1	Ol
2	28		11.98	0.14	-0.57	B3		1	
2	29		12.25	0.15	-0.01	B8		1	
2	30	308597	11.20	0.16	-0.48	B4		1	
2	31	308596	11.13	0.11	-0.58	B3		1	
2	32	308598	11.07	0.12	-0.62	B3		1	
2	33		11.04	1.58	1.76	G5	K2 III	2	U
2	34	100162	10.07	0.13	-0.12	B8		2	
2	35	100163	9.91	0.27	0.11	B8-9		1	uvby,H
2	36		11.95	0.26	0.07	B8		1	
2	37		11.48	0.15	-0.46	B4		1	
2	38	308583	10.93	0.14	-0.56	B3		2	
2	39		11.57	0.56	0.06	F6		1	
2	40	308589	10.78	0.20	-0.14	B7		1	
2	41		12.74	0.22	-0.34	B6		1	
2	42		11.87	0.15	-0.50	B3		1	
2	43		12.10	0.14	-0.41	B5		1	
2	44		12.11	0.60	0.13	F5		1	
2	45	100200	9.21	0.08	-0.28	B7		2	
2	46		12.30	0.46	-0.48	B0		3	
2	47		12.79	0.52	0.24	(F0)		1	
2	48		11.79	0.45	0.25	A7		1	
2	49		12.00	0.21	-0.45	B3		3	
2	50		11.83	0.17	-0.44	B3		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
2	51	308599	11.62	0.28	-0.43	B3		1	
2	52		11.52	0.56	0.24	F0		1	
2	53	100243	9.94	0.11	-0.75	B2		2	
2	54		11.80	1.24	0.97	(K5)	G8 III	1	
2	55		12.31	0.24	-0.11	B8		1	
2	56	308613	11.28	0.30	-0.41	B4		1	
2	57		11.41	0.86	0.41	G8		2	
2	58		12.88	0.32	-0.11	B8		1	U
2	59	308600	10.54	1.17	0.84	G5	G8 III	1	
2	60		12.26	0.41	0.22	A0		1	
2	61	100263	9.65	0.11	-0.77	B0		1	
2	62		12.02	0.64	0.08	F6		1	
2	63		13.25	0.24	-0.03	B4		1	U
2	64	308606	10.95	0.23	-0.52	B3		1	
2	65		13.32	0.66	0.15	(F6)		1	
2	66		13.05	0.37	0.18	A0		1	U
2	67		13.66	0.24	-0.06	(B8-9)		1	
2	68	100295	9.02	1.25	1.20	K0	K1 III	1	
2	69		11.90	0.14	-0.45	B4		2	
2	70		11.07	1.74	2.0	M1	M0 III	1	
2	71	308605	11.46	0.24	0.12	A0		1	
2	72		13.16	0.59	0.40	(A5)		2	
2	73	308601	10.38	0.12	-0.75	B1		1	
2	74		12.36	0.26	0.16	(A0)		1	
2	75	308608	11.55	0.41	0.34	A7		2	
2	76		13.05	0.57	0.21	F0		1	O1,U
2	77		12.70	0.19	0.06	B8		1	O1
2	78		13.10	0.26	-0.21	(B6)		1	
2	79		12.54	0.40	0.19	A0		1	
2	80		13.15	0.12	-0.34	(B6)		1	
2	81		11.48	0.22	-0.61	B2		1	
2	82		13.37	0.64	0.01	(F7)		1	
2	83		12.63	0.61	0.02	(F7)		2	
2	84		11.73	1.41	1.52	(M0)	K2 III	1	
2	85		12.83	0.30	0.18	A0		2	U
2	86		11.91	0.20	0.06	B8-9		2	
2	87		12.47	0.67	0.06	F5		1	
2	88		13.52	0.45	0.13	(B9)		1	
2	89		12.66	0.43	0.23	(A7)		1	
2	90		12.11	1.14	0.80	(K5)	G5 III	1	
2	91		12.65	0.13	-0.30	(B6)		1	
2	92		13.14	0.62	0.03	(F5)		2	
2	93		12.93	0.27	-0.36	B7		1	U
2	94		11.86	0.52	0.31	A7		1	
2	95		13.39	0.43	0.06	(B9)		1	
2	96		12.42	0.42	0.28	A0		1	
2	97		11.84	0.68	0.11	G0		1	
2	98		12.34	1.26	0.89	(K5)	G5 III	1	
2	99		11.33	0.75	0.26	F2	F5 III	1	
2	100		11.71	0.63	0.10	F4		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
2	101		12.04	1.27	1.18	(K5)	K0 III	1	
2	102		11.17	0.66	0.14	F7		1	
2	103	308607	10.54	0.26	-0.49	B4		2	
2	104	308680	10.48	1.30	1.22	K3	K1 III	1	
2	105		12.56	0.24	-0.40	B5		1	
2	106		12.10	1.39	1.4	(K7)	K1 III	1	
2	107	308604	10.15	0.11	-0.70	B2		1	
2	108		12.56	1.27	1.1	(K7)	K0 III	1	
2	109		11.99	0.39	0.26	A0		1	
2	110		11.51	1.74	1.8	(M5)	K3 III	1	
2	111		11.29	1.75	1.9	(M5)	K3 III	1	
2	112		11.72	0.30	-0.54	B0		1	
2	113	308602	11.72	0.20	-0.62	B3		1	01
2	114		12.43	0.20	-0.18	B8		1	
2	115	100444	8.42	0.21	-0.75	B0	B0 II	2	uvby,H
2	116	308603	10.09	1.52	1.47	K2	K2 III	1	
2	117		12.45	0.58	0.03	(F5)		1	
2	118		13.50	0.37	0.28	A0		1	U
2	119		13.12	0.60	0.09	(F5)		1	
2	120		11.91	1.23	0.91	(K5)	G8 III	1	
2	121		11.40	0.97	0.66	F8	G0 III	1	
2	122		11.80	0.55	0.12	F0		1	
2	123		10.98	1.29	1.19	K2	K0 III	1	
2	124	100495	9.62	0.15	-0.70	B1		2	
2	125		12.15	0.31	-0.13	(B7)		2	
2	126		13.02	0.31	0.37	A1		1	U
2	127		13.27	0.30	0.40	B9		1	U
2	128		11.09	0.89	0.52	F5	F7 III	1	
2	129		12.50	0.26	-0.09	B8		1	
2	130		11.79	0.67	0.16	F0		2	
2	131		12.19	0.34	0.23	A0		1	
2	132	308702	11.01	0.19	-0.50	B4		1	
2	133		12.99	0.41	0.19	(A7)		1	
2	134		12.98	0.36	0.18	A2		1	U
2	135	308707	9.97	1.19	1.06	K0	K0 III	1	
2	136	308681	11.72	0.14	-0.29	B6		1	
2	137	308703	10.34	0.83	0.65	A3	A5 IB	3	
2	138		12.21	0.13	-0.32	B7		1	01
2	139	308704	11.19	0.10	-0.63	B3		2	
2	140		11.99	0.14	-0.49	B4		1	
2	141	308701	11.71	0.23	0.09	B8-9		1	
2	142		13.32	0.33	0.36	(A1)		1	
2	143		13.08	0.37	0.32	(A1)		1	
2	144		12.77	0.18	-0.07	B9		1	
2	145		13.12	0.15	-0.12	(B8)		2	
2	146	308700	11.67	0.16	-0.55	B3		2	01
2	147		12.62	0.53	-0.26	B6	B3 III	2	01,D
2	148		12.41	0.10	-0.37	B7		1	
2	149	308705	10.83	0.72	0.16	G0		1	
2	150		12.29	1.19	0.94	F6	F7 II	1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
2	151		11.85	1.10	0.70	(K0)	G5 III	1	
2	152		12.59	0.35	0.35	B9		2	
2	153		12.27	0.46	0.09	B9		1	O1*
2	154		12.06	0.43	-0.30	B6		2	*
2	155	308679	10.81	0.53	0.20	F1		2	
2	156	308699	11.25	0.08	-0.60	B2		2	
2	157		11.52	1.26	1.08	(K5)	K0 III	2	
2	158		11.05	1.45	1.45	G8	K1 III	2	
2	159		12.09	0.23	-0.03	B8-9		1	
2	160	308706	11.66	0.38	0.24	A0		1	
2	161		12.20	0.58	0.05	(F5)		1	
2	162	308697	11.36	0.16	-0.14	B8		3	
2	163	308698	10.67	0.24	0.16	A0		2	
2	164		11.25	1.72	2.0	(M5)	K5 III	3	
2	165		12.18	0.36	0.23	A2		1	
2	166	308682	10.74	0.56	0.07	F4		2	
2	167	308696	10.88	0.67	0.17	F5		2	
2	168		11.96	0.58	0.06	F5		1	
2	169		12.75	1.20	0.45	(G0)	A0 IB	2	
2	170		12.47	0.61	0.02	(F7)		1	
2	171		11.91	1.25	0.79	(G8)	G8 III	1	
2	172		12.48	0.16	-0.06	B8		1	
2	173		12.40	0.28	0.08	B8		1	
2	174		12.84	0.28	0.07	(B9)		1	
2	175	308683	10.28	1.20	1.08	G8	G8 III	1	
2	176	308694	10.24	1.50	1.70	K4	K2 III	1	
2	177	308695	10.04	1.78	1.91	M0	M0 III	1	
2	178	308708	11.64	0.33	0.18	A0		1	
2	179		10.91	1.69	1.96	K0	K3 III	1	U
2	180		12.96	0.28	0.20	(A0)		1	
2	181		12.14	0.37	-0.40	(B2)		1	
2	182		11.78	0.72	0.27	G2		1	
2	183		12.20	0.17	-0.08	B8-9		1	
2	184	308687	10.50	1.17	0.99	K0	G8 III	1	
2	185	308709	11.62	0.28	0.17	B9		1	
2	186		12.39	0.69	0.06	(G0)		1	
2	187		11.40	0.91	0.45	F7	F7 III	1	
2	188		12.33	0.25	0.18	B9		1	
2	189		11.89	0.44	0.27	B8		1	*
2	190	100791	8.72	1.50	1.66	K4	K3 III	1	uvby,H
2	191		12.22	0.19	-0.25	(B6)		1	
2	192	308693	11.09	0.21	-0.61	B2		1	O1
2	193	-62 2124	10.99	0.08	-0.77	B0		1	
2	194	-62 2125	11.32	0.11	-0.63	B2		1	
2	195	308710	11.56	0.12	0.03	B9		1	
2	196		11.62	0.75	0.26	(G8)		1	
2	197	308711	9.15	1.42	1.52	K5	K3 III	1	uvby,H

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
3	1	106730	8.62	0.06	-0.92	O6		3	*
3	2		11.46	0.22	0.05	B9		1	
3	3	-64 1840	10.15	0.05	-0.42	B5		1	
3	4	-63 2227	10.13	1.27	1.13	K0	K0 III	2	
3	5	106781	9.31	-0.02	-0.70	B2		1	
3	6	106796	9.21	0.17	0.11	B8-9		1	
3	7		11.81	0.07	-0.52	B3		1	O1
3	8	-64 1846	10.19	0.06	-0.43	B5		2	
3	9		11.75	0.54	0.06	F5		1	
3	10		12.05	0.10	-0.39	B4		1	
3	11		10.84	1.14	0.83	K0	G8 III	1	
3	12	-64 1849	10.89	0.07	-0.33	B6		1	
3	13		10.78	1.09	0.79	G8	G8 III	2	
3	14		11.22	0.97	0.55	G0	G0 III	1	O1
3	15		12.26	0.28	0.21	A2		1	
3	16	106874	9.19	1.26	1.19	K0	K1 III	1	
3	17		11.66	0.38	0.23	A0		1	
3	18	-63 2232	9.57	1.07	0.79	G3	G5 III	2	
3	19		12.36	0.24	0.02	A3		2	
3	20		11.44	0.34	0.18	A0		3	
3	21		11.48	0.13	-0.46	B2		2	
3	22		11.70	0.23	0.12	A0		1	
3	23		11.97	0.33	0.23	A2		2	
3	24		12.05	0.42	0.21	B7		2	
3	25		11.97	0.21	0.06	B8		2	
3	26		11.79	0.50	0.33	A3		1	
3	27	106984	8.13	1.65	1.86	K3	K5 III	2	uvby,H
3	28	-64 1855	10.12	0.13	-0.30	B3		2	
3	29		10.47	1.45	1.56	G8	K0 II	1	
3	30		12.22	0.42	0.29	A4		2	Var*
3	31		12.34	0.32	0.18	B7		1	
3	32		11.66	0.24	-0.13	B7		1	
3	33	107050	9.26	0.34	0.16	A0	A1 II	2	uvby,H
3	34		11.55	0.27	0.18	B9		1	
3	35		10.19	1.22	1.08	G5	G5 II	3	
3	36		12.24	1.33	1.2	F5	K0 III	1	U
3	37		12.16	0.36	0.19	A2		1	
3	38	107111	9.86	0.19	0.12	B8		2	
3	39		10.88	0.44	0.16	B9	B9 III	1	O1
3	40		12.84	0.28	0.17	A0		2	U
3	41		12.25	0.58	0.04	F4		1	
3	42		11.82	1.69	1.9	(M5)	K3 III	1	
3	43		12.42	0.22	0.12	B9		1	
3	44		10.94	0.93	0.53	F9	G0 III	1	
3	45	-64 1859	9.90	0.97	0.61	G5	G5 III	2	
3	46		10.84	1.69	1.72	K5	K3 III	1	
3	47		12.84	0.20	0.06	A2		1	O1,U
3	48		12.47	0.45	0.29	A4		1	
3	49	-64 1860	10.57	0.23	0.19	A0		2	
3	50	-64 1861	10.09	0.06	-0.59	B3		2	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
3	51	107154	9.75	0.09	-0.36	B4		1	
3	52	-64 1863	9.57	1.53	1.81	K3	K3 III	1	
3	53		12.36	0.40	0.23	B9		1	
3	54		12.42	0.29	0.10	A0		1	
3	55		12.28	0.52	0.26	(A8)		1	
3	56	107190	8.65	1.77	2.13	K5	M0 III	2	
3	57		12.26	0.17	-0.06	B8		1	
3	58		12.09	0.29	0.19	B9		1	
3	59		11.65	0.26	-0.08	B9		1	O1
3	60		12.39	0.14	-0.16	B5		1	
3	61	-64 1864	10.71	0.22	0.14	A0		2	
3	62	107223	8.18	0.09	0.04	B9		2	uvby,H
3	63		11.96	0.15	0.00	B9		3	
3	64		12.22	0.26	-0.10	B8		1	
3	65		11.85	0.43	0.13	A8		1	
3	66		12.04	0.17	0.01	B8		1	
3	67	107269	8.72	1.68	1.80	M0	K5 III	2	
3	68		11.00	1.53	1.78	G8	K2 III	2	
3	69		11.16	0.41	0.12	A8		1	
3	70	107270	7.12	1.10	0.77	G5	G5 II	1	uvby,H,O
3	71		12.40	0.24	0.12	B9		1	
3	72		11.83	0.12	-0.40	B6		1	
3	73		12.60	0.10	-0.12	B9		1	
3	74		11.67	0.19	0.03	B9		1	
3	75		11.81	0.25	0.16	B9		2	
3	76	107300	9.98	0.07	-0.59	B0		1	
3	77		11.02	1.03	0.70	G5	G5 III	1	
3	78		12.42	0.20	-0.07	B8		1	
3	79		11.72	0.10	-0.53	B3		3	
3	80		10.61	1.85	2.16	K2	K5 III	1	
3	81		12.16	0.33	0.16	B8		1	
3	82		11.66	0.23	0.06	B9		2	
3	83		11.71	0.22	0.05	B8		1	
3	84		11.22	0.14	-0.29	B8		1	O1
3	85	-63 2247	10.03	0.76	0.47	A3	A7 IB	1	O1
3	86		12.19	0.35	0.12	A0		1	
3	87		11.86	0.52	0.22	(F0)		1	
3	88	107338	9.26	0.21	0.15	B8		1	
3	89	107357	7.99	0.93	0.60	G5	G5 III	1	uvby,H
3	90		11.60	0.78	0.30	G0		1	
3	91		11.56	0.38	0.29	A5		1	
3	92		10.77	1.08	0.78	G5	G5 III	1	
3	93		12.43	0.44	0.15	A8		1	
3	94		11.66	0.38	0.23	A4		1	
3	95		11.77	0.21	-0.08	B9		1	
3	96		12.27	0.33	0.28	A0		2	
3	97		12.06	0.56	0.12	F5		1	O1
3	98		11.86	0.21	0.12	A0		1	
3	99	-63 2248	9.97	0.51	0.05	F5		1	uvby,H
3	100		12.19	0.46	0.11	(F1)		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
3	101		11.98	0.25	-0.05	B9		1	
3	102		11.90	0.80	0.31	G2		1	
3	103		11.18	1.16	0.99	(K5)	K0 III	1	
3	104		12.25	0.32	0.26	A0		2	O1
3	105		12.45	0.42	0.31	A5		1	
3	106		13.16	0.24	-0.01	(B9)		1	
3	107		12.22	0.20	-0.21	(B7)		1	
3	108		12.58	0.19	0.02	B8		1	
3	109		11.55	0.54	0.02	F5		2	
3	110		12.29	0.29	0.22	B9		2	
3	111		12.71	0.48	0.22	A1		1	U
3	112		12.10	0.70	0.20	(F8)		1	
3	113		11.53	0.09	-0.05	B9		1	O1
3	114		12.61	0.35	0.19	(A0)		1	
3	115		12.47	0.19	0.12	B9		1	
3	116	-64 1873	9.94	0.10	-0.23	B8		1	
3	117		12.19	0.20	-0.35	(B5)		1	
3	118	-64 1874	10.15	0.01	-0.77	O9		1	
3	119		12.79	0.17	0.12	A0		1	U
3	120		12.47	0.53	0.07	F0		1	U
3	121		11.71	0.15	-0.16	B8		1	
3	122		10.50	0.64	0.07	G0		1	O1
3	123		11.62	0.80	0.41	(G9)		1	
3	124		10.11	1.67	1.88	K3	K4 III	2	
3	125	107527	9.40	-0.02	-0.59	B3		1	
3	126		11.52	0.26	0.22	A0		2	
3	127		12.63	0.23	-0.33	(B5)		1	
3	128	107565	8.67	0.14	-0.70	O9		1	
3	129		11.25	0.68	0.19	F8		1	
3	130		10.23	0.96	0.64	F6	G0 III	1	
3	131		11.74	0.42	0.20	A2		1	O1
3	132		12.13	0.39	0.24	A5		1	
3	133	107581	9.43	0.03	-0.77	O9		1	
3	134		12.13	0.22	-0.26	B4		1	
3	135	-63 2250	10.78	0.16	-0.16	B7		1	
3	136	-64 1880	10.69	0.32	-0.05	B3		3	
3	137	107592	7.54	1.29	1.27	K0	K2 III	1	uvby,H
3	138		12.58	0.33	-0.11	B8		3	
3	139		10.86	0.21	-0.17	B4		2	
3	140		11.99	0.28	0.17	B9		2	
3	141	-63 2252	10.70	0.15	-0.48	B5		1	O1
3	142	-63 2253	10.46	0.13	-0.20	B8		1	
3	143	-64 1884	10.28	0.02	-0.66	B0		1	
3	144	-64 1885	10.85	0.08	-0.61	B1		1	
3	145		11.71	0.34	0.20	B5		1	
3	146	107720	7.12	1.12	1.04	K0	K1 III	3	uvby,H,O
3	147	-64 1887	10.40	0.17	-0.25	B7		1	
3	148		11.11	0.27	-0.08	B6		2	
3	149		11.66	0.28	0.12	A1		1	
3	150		12.00	0.42	0.24	A0		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
3	151		12.40	0.16	0.07	B9		1	
3	152		10.88	0.60	0.06	F5		2	
3	153	-63 2256	10.88	0.27	0.00	B8		2	
3	154		10.44	1.78	2.06	K5	K5 III	1	
3	155	-63 2257	10.69	0.18	0.02	B8		1	
3	156	107790	9.06	0.00	-0.56	B3		1	
3	157	-64 1890	10.38	0.03	-0.69	B2		1	
3	158		10.80	1.44	1.28	G8	K1 III	1	
3	159		11.23	1.30	1.14	G8	K0 III	1	
3	160	-64 1891	10.82	0.03	-0.66	B2		1	
3	161		12.01	0.23	0.16	A2		1	
3	162		11.63	0.34	0.20	A0		1	
3	163		11.61	0.17	-0.41	B5		1	
3	164		10.47	1.81	2.10	K8	M0 III	1	
3	165		10.22	1.44	1.42	K0	K2 III	1	
3	166	-63 2262	10.86	0.13	-0.54	B3		1	
3	167	-64 1893	10.90	0.18	-0.17	B6		1	
3	168		11.11	0.20	-0.69	O7		1	
3	169		12.06	0.34	0.06	B8		1	
3	170	107945	8.05	1.28	1.28	K0	K III	1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
4	1	-61 3652	11.26	0.53	0.31	F0		1	
4	2	-61 3653	10.63	0.86	0.32	G0	G0 III	1	
4	3		12.00	0.48	0.31	A3		1	
4	4		11.84	0.17	0.00	B9		1	
4	5	-61 3656	11.22	0.18	-0.24	B8		1	
4	6		11.93	0.38	0.28	A2		1	
4	7	-61 3657	11.89	0.29	0.28	A1		1	
4	8	116313	9.45	1.44	1.47	K0	K2 III	1	
4	9	116314	9.88	0.05	-0.47	B5		1	
4	10	-61 3660	10.67	0.25	0.04	B8-9		1	
4	11	-61 3661	11.48	0.18	-0.24	B8		1	O1
4	12		11.87	0.46	0.16	A2		1	O1
4	13		12.39	0.18	-0.18	B6		1	
4	14	-61 3664	11.14	0.33	0.20	A0		1	
4	15		11.66	0.85	0.24	F0	F7 III	1	O1
4	16	-61 3666	9.41	1.26	1.12	(K5)	K0 III	1	
4	17	-61 3667	9.75	0.66	0.15	F5		2	
4	18		12.12	0.22	0.16	B9		1	
4	19	-61 3668	10.21	0.67	0.19	G3		1	
4	20		11.69	0.34	0.23	A0		1	
4	21	116374	9.00	0.22	0.13	B8-9		1	uvby,H
4	22		12.09	0.38	0.29	B9		2	
4	23	-61 3670	10.92	0.24	0.08	B9		1	
4	24	-61 3671	11.08	0.21	-0.17	B8-9		1	
4	25		12.28	0.49	0.22	(A9)		2	
4	26	-61 3672	10.23	1.21	1.04	G8	G8 III	1	
4	27	-61 3673	9.81	1.12	0.88	G8	G8 III	1	
4	28	-61 3674	11.07	0.38	0.22	A2		1	
4	29		11.99	0.31	-0.14	B8		2	
4	30	-61 3675	10.45	0.18	-0.29	B6		1	
4	31	-61 3677	10.92	0.20	0.07	B8		3	
4	32		12.47	0.46	0.22	A8		1	
4	33	116456	10.09	0.15	-0.04	B8		1	
4	34	-61 3679	10.94	0.31	0.29	A3		2	
4	35		11.73	0.38	-0.05	B8		2	
4	36		12.57	0.64	0.18	F0		1	U
4	37	-61 3681	10.78	0.55	0.27	F0		2	
4	38	-61 3683	11.07	0.38	0.22	A0		1	
4	39		10.95	1.36	1.38	K0	K1 III	1	U
4	40		13.19	0.48	0.36	(A2)		1	
4	41	-61 3684	10.20	1.10	0.82	K2	G8 III	1	
4	42		12.03	0.46	0.21	A7		1	
4	43		11.14	1.11	1.06	G8	K0 III	1	
4	44	-61 3685	10.78	0.71	0.16	F5		1	
4	45		12.52	0.32	-0.11	(B7)		1	
4	46		12.18	0.55	0.28	A8		1	
4	47		12.20	0.18	-0.02	B9		1	
4	48		12.48	0.52	0.30	A2		1	
4	49		11.36	0.14	-0.12	(B8-9)		1	
4	50	116589	9.39	0.10	-0.27	B7		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
4	51	-61 3687	11.21	0.13	-0.30	B6		1	
4	52		12.96	0.48	0.46	A8		1	U
4	53	116607	8.99	0.13	0.02	B9		1	
4	54		11.46	1.26	1.01	(K5)	G8 III	1	
4	55	-61 3689	10.42	0.13	-0.47	B5		1	
4	56		12.55	0.51	0.16	(F0)		1	
4	57	-61 3690	11.64	0.33	0.23	B9		2	
4	58	-61 3691	11.63	0.37	0.25	A0		2	
4	59		11.70	0.33	-0.14	B7		1	
4	60		11.92	0.69	0.18	F4		1	
4	61		13.03	0.11	-0.27	(B7)		1	
4	62		12.02	0.24	0.03	A0		1	
4	63		12.68	0.56	0.51	A0	A0 III	1	U
4	64		11.04	1.19	0.98	G8	G8 III	1	
4	65		11.88	0.67	0.35	G0		1	Ol
4	66		12.65	0.41	0.31	A1		1	U
4	67	-61 3692	9.68	1.34	0.28	O9	O9 IA	4	uvby,H*
4	68		12.69	0.44	0.08	F2		1	U
4	69		13.03	0.50	0.41	(A1)		1	
4	70	-61 3693	11.23	0.27	-0.26	B7		1	
4	71		11.11	1.28	1.14	G8	K0 III	2	
4	72		12.41	0.98	0.66	(K1)		1	
4	73	-61 3694	10.94	0.80	0.19	G0		2	
4	74		12.54	0.64	0.12	(F5)		1	
4	75	-61 3695	10.09	0.67	0.17	F5		1	
4	76	-61 3696	11.06	0.62	0.12	F5		1	
4	77		12.38	0.38	0.20	A0		1	
4	78		11.99	0.22	0.09	B9		1	
4	79		12.27	0.37	0.22	B9		1	
4	80	-62 3260	10.96	0.34	0.21	A2		1	
4	81		12.23	0.29	0.23	A2		1	
4	82		12.42	0.46	0.35	A8		1	
4	83	-61 3697	10.92	0.26	-0.02	B7		1	
4	84	-61 3698	11.43	0.41	-0.25	B2		1	
4	85		12.40	0.62	0.38	A5	F0 III	1	
4	86		12.37	0.25	-0.35	(B4)		1	
4	87		12.72	0.46	0.29	(A7)		1	
4	88		12.19	0.43	0.36	A0		2	
4	89	-61 3699	10.80	0.56	0.06	F5		1	
4	90		11.70	0.30	0.23	A1		2	
4	91		11.38	0.60	0.15	F0		2	
4	92		10.94	2.70	2.2	M5	M2 IB	8	uvby,H,Var*
4	93		11.92	0.36	0.27	B8		1	
4	94	-61 3700	11.44	0.19	-0.44	B5		1	
4	95	116734	8.39	0.48	0.03	F5		1	uvby,H
4	96		12.84	0.45	0.37	(A1)		1	
4	97		12.27	0.34	0.16	(A0)		1	
4	98		12.24	0.35	0.23	A0		1	
4	99		12.50	0.37	0.22	(A0)		1	
4	100		11.35	0.85	0.27	G0		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
4	101		12.37	0.75	0.62	(A1)	A5 II	1	
4	102	-61 3701	11.41	0.38	0.21	B8	B9 III	1	
4	103		12.64	0.60	0.23	(F1)		1	
4	104		11.35	0.19	-0.09	B8		2	
4	105		12.57	0.31	0.22	(A2)		1	
4	106		12.78	0.51	0.23	(A8)		1	
4	107		12.72	0.68	0.15	(F5)		1	
4	108		11.00	1.76	1.56	M3	G8 IB	1	
4	109		12.33	0.28	0.08	B9		1	
4	110		11.92	0.88	0.49	(K0)		1	
4	111	116781	7.62	0.12	-0.93	O8	O9 IAB	10	uvby,H*
4	112	-61 3702	10.46	0.33	0.25	A2		1	
4	113	-61 3703	11.00	0.32	0.26	A1		2	
4	114	116795	9.51	0.09	-0.48	B5		2	
4	115		11.74	0.29	-0.34	B5		1	
4	116		12.31	0.33	0.16	B9		1	
4	117		12.79	0.32	0.22	A5		1	U
4	118		11.65	0.22	-0.31	B6		1	
4	119		11.89	0.15	-0.07	B8		1	
4	120		13.09	0.27	0.02	A0		1	U
4	121	-61 3705	11.38	0.15	-0.45	(B3)		1	
4	122		11.39	1.46	1.51	(M1)	K2 III	1	
4	123		13.29	0.29	0.19	(A0)		1	
4	124		12.48	0.30	-0.02	(B8)		1	
4	125	116827	9.51	0.11	-0.57	B3		1	
4	126	-61 3707	11.08	0.15	-0.47	(B3)		1	
4	127	-61 3708	11.33	0.22	0.14	B9		1	
4	128		12.76	0.70	0.02	(F7)		1	
4	129		13.29	0.14	0.09	(B9)		1	
4	130		12.67	0.42	0.23	A7		1	U
4	131		11.60	0.26	0.16	B9		1	
4	132	116826	10.14	0.20	-0.06	B8		1	
4	133		11.78	0.81	0.27	G5		1	
4	134		11.85	1.44	1.6	(M0)	K3 III	1	
4	135		11.54	0.49	0.22	F2		1	
4	136		12.54	0.50	-0.36	(B2)		1	
4	137	116841	8.51	1.64	1.96	K5	K5 III	1	
4	138		10.86	1.50	1.46	G8	K2 III	1	O1
4	139		12.28	0.64	0.18	(F4)		1	
4	140	-61 3711	10.87	0.47	0.26	A2		1	
4	141		12.14	1.20	0.97	(K2)	G8 III	1	
4	142		13.34	0.47	0.12	(B9)		1	
4	143		12.09	0.15	-0.28	B8		1	O1
4	144		12.26	0.25	-0.04	B9		1	O1
4	145		12.97	0.21	-0.08	(B8-9)		1	
4	146		12.80	0.62	0.30	(F0)		1	
4	147		13.12	0.26	-0.07	(B8)		1	
4	148	-61 3712	11.32	0.16	-0.44	B5		1	O1
4	149	-61 3713	11.46	0.17	-0.35	B6		1	
4	150	-61 3714	10.57	0.17	-0.46	B5		2	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
4	151	-61 3715	11.10	0.18	-0.55	B3		1	
4	152		11.97	0.64	0.16	(F5)		1	
4	153		12.02	0.34	0.24	A0		2	
4	154	-61 3716	11.08	0.36	-0.24	B5		1	*
4	155	-61 3718	10.06	0.21	-0.33	B6		1	
4	156		13.01	0.24	-0.12	(B8)		1	
4	157		10.63	1.56	0.80	G5	G0 IB	3	Ol,uvby,H
4	158		11.39	1.01	0.63	G3	G0 III	2	Var*
4	159		12.30	0.23	-0.17	B8		1	
4	160		10.89	1.16	0.78	F8	F8 II	1	
4	161		11.94	0.42	0.06	B9	B9 III	2	
4	162	116888	10.12	0.24	0.18	B9		2	
4	163		12.29	0.60	0.04	(F5)		1	
4	164		11.18	0.82	0.27	G2		2	
4	165		12.82	0.46	0.19	(B9)		1	
4	166		12.91	0.15	-0.13	B9		1	U
4	167	-61 3725	10.26	0.61	0.34	F0	F2 III	1	
4	168	-61 3726	10.30	0.46	-0.54	B0		2	
4	169		11.80	0.35	-0.14	B8		1	
4	170		11.56	1.13	0.58	(G5)	G5 III	1	
4	171		12.70	0.62	0.08	(F5)		1	
4	172	-61 3727	9.81	0.87	0.39	G5	G0 III	2	
4	173		12.81	0.47	0.29	(A7)		1	
4	174		12.52	0.55	0.05	(F2)		1	
4	175	-61 3728	10.36	1.41	1.41	K1	K1 III	1	
4	176		12.59	0.50	0.24	A8		1	
4	177		11.67	0.56	0.07	F5		1	
4	178		12.08	0.67	0.28	B1		1	U
4	179	116951	9.62	0.26	0.23	A2		2	
4	180	-61 3730	10.62	0.67	0.18	F8		1	
4	181		12.31	0.48	0.30	B8		2	*
4	182		11.67	0.64	-0.30	B3	B3 III	1	
4	183	117000	6.64	1.06	0.58	F8	G0 II	3	uvby,H,O
4	184	-61 3733	11.50	0.29	0.16	(A0)		2	
4	185		12.34	0.29	0.05	A0		1	
4	186		11.25	1.14	0.30	B3	B3 IB	1	*
4	187		12.36	0.92	0.61	G8		1	U
4	188	-61 3734	11.13	0.43	0.15	A5		1	
4	189		12.30	0.46	0.32	(A3)		1	
4	190		11.81	0.58	0.15	F2		1	
4	191	117059	9.23	1.23	1.14	K0	K0 III	2	
4	192		10.73	1.32	1.16	K0	K0 III	1	
4	193	-61 3736	9.86	0.24	-0.66	B2		2	
4	194		11.33	1.50	1.46	(M2)	K2 III	1	
4	195		11.48	0.84	0.42	(G9)		1	
4	196	-61 3737	10.54	0.53	0.10	F2		1	
4	197		12.19	0.25	-0.16	B8		1	
4	198		10.74	1.42	1.55	K2	K2 III	1	U
4	199		11.34	0.62	0.12	F4		1	
4	200		11.58	0.34	-0.21	B8		2	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
4	201		10.99	1.16	0.87	F6	F5 IB	1	
4	202	117134	9.51	0.17	-0.74	B2		2	
4	203		11.91	0.32	0.00	B9		1	
4	204	-61 3742	9.58	1.25	0.86	A8	F0 IB	3	*
4	205	117185	9.83	0.12	-0.29	B8		1	
4	206	117195	9.50	0.62	0.12	G5		1	
4	207		11.55	0.35	0.09	B8		1	
4	208	117196	9.80	0.32	0.28	A2		2	
4	209	-61 3749	11.02	0.24	0.14	B9		1	
4	210		11.72	0.31	0.18	A0		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
5	1	-52 8782	11.30	0.48	0.27	A7		1	
5	2	-52 8783	11.23	0.63	0.08	F8		1	
5	3	-51 8468	10.69	0.15	0.14	A2		1	
5	4	-52 8789	12.04	0.42	0.13	F0		1	
5	5	-52 8790	12.00	0.50	0.02	F0		1	
5	6	-52 8792	11.82	0.44	0.13	A0		1	
5	7	-51 8491	12.26	0.34	0.12	(B9)		4	
5	8	-51 8493	10.54	0.32	0.22	A2		2	Str
5	9	-51 8494	10.91	0.28	0.17	A0		2	Str
5	10	-52 8801	12.12	0.36	0.22	B9		1	
5	11	-52 8799	10.86	0.48	0.12	F3		1	
5	12	140222	9.34	-0.02	-0.31	B7		1	
5	13	140221	9.44	0.03	-0.06	B9		1	Str
5	14		13.13	0.67	0.25	(F2)		1	
5	15	-51 8499	11.46	0.34	0.17	A0		1	Str
5	16	-52 8807	11.29	1.04	0.71	G1	G2 III	3	Ol
5	17		11.66	1.46	1.42	(M0)	K2 III	3	
5	18	-52 8809	11.13	0.46	0.17	F0		1	
5	19	-52 8812	11.95	0.40	0.18	A7		1	
5	20	-52 8814	10.80	1.27	1.62	G8	K0 III	1	
5	21	-51 8501	11.86	0.86	0.40	(G8)		1	
5	22	-51 8502	10.42	0.32	0.27	A2		1	
5	23	-51 8503	9.95	0.28	0.18	A1		1	Str
5	24	-51 8506	10.79	0.41	0.33	B8		1	Str
5	25	140289	8.51	1.21	1.11	K0	K0 III	1	
5	26	140288	9.42	0.17	-0.37	B5		1	Str
5	27	-51 8508	11.11	0.31	0.19	A4		1	Str
5	28	-51 8509	9.67	1.41	1.47	K0	K2 III	1	
5	29	-52 8819	11.33	0.12	-0.22	B8		2	
5	30		13.22	0.66	-0.03	(F8)		1	
5	31	-51 8510	10.99	0.14	0.12	A0		1	Str
5	32		12.77	0.70	0.20	(G5)		1	
5	33	-52 8822	11.25	0.21	0.14	A0		1	
5	34		12.74	0.56	0.01	(F8)		1	
5	35		12.64	0.54	0.16	(F2)		1	
5	36		12.76	0.73	0.21	F2		1	U
5	37	-52 8823	11.81	0.26	0.22	A0		1	
5	38		12.71	0.60	0.38	(A7)		1	
5	39		12.74	0.79	0.53	A8	F0 III	1	U
5	40		12.76	1.14	1.0	(K5)	G8 III	1	
5	41	140354	8.31	1.80	2.04	K5	K5 III	1	uvby,H
5	42		12.83	0.71	0.08	F8		1	U
5	43		12.14	0.45	0.38	B7		1	
5	44		12.17	1.32	0.75	(G5)	G8 III	1	
5	45	-51 8515	10.83	1.40	1.08	(K2)	K1 III	1	
5	46	-51 8518	10.87	0.49	0.05	F5		1	Str
5	47		13.49	0.70	0.46	(G5)		1	
5	48		12.70	0.53	0.08	F5		1	U
5	49	-52 8833	10.99	1.14	0.86	G3	G5 III	1	Ol
5	50		12.51	0.42	0.28	B8		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
5	51		11.88	0.91	0.24	G8		1	
5	52	-52 8835	11.49	0.70	0.09	G2		1	
5	53		12.42	0.48	0.42	A0		1	
5	54		12.87	0.43	0.16	F0		1	U
5	55		12.62	0.58	0.13	F0		1	U
5	56	-52 8836	10.07	1.88	2.08	M0	M0 III	1	
5	57	-52 8839	11.33	0.39	0.14	A3		1	
5	58	-52 8840	11.78	0.69	0.16	F2		1	
5	59	-51 8522	10.49	1.24	1.17	K0	K0 III	1	Str
5	60		12.41	0.38	0.38	A1		1	
5	61		11.63	1.15	0.69	F0	F5 II	1	
5	62	-52 8841	11.12	0.43	0.10	A5		1	
5	63		12.42	0.39	0.02	(B8)		1	
5	64		13.01	0.49	0.22	(A9)		1	
5	65		13.05	0.82	0.66	(K0)		1	
5	66	-52 8844	10.56	0.11	0.05	B9		1	
5	67		13.20	1.10	0.5	(K0)	G0 III	1	
5	68	-52 8845	11.40	0.22	0.14	B9		1	
5	69	-51 8525	11.31	0.65	0.16	F5		2	
5	70		12.48	0.29	0.21	B9		1	
5	71	-52 8846	11.15	0.53	0.23	F3		1	
5	72	-51 8527	11.09	1.33	1.40	G8	K0 III	1	
5	73		12.62	1.67	1.8	(M5)	K3 III	1	
5	74	140447	8.17	0.09	0.04	B9		1	uvby,H
5	75		12.20	0.49	0.02	(F5)		1	
5	76	-51 8528	10.54	0.23	0.19	A5		2	
5	77		12.89	0.43	0.21	(A8)		1	
5	78		12.87	0.50	0.45	A1		1	U
5	79	-52 8851	11.81	0.64	0.18	F8		1	
5	80		12.26	0.47	0.22	(A8)		1	
5	81	-51 8533	11.24	0.17	-0.10	B8		1	
5	82		12.79	0.42	0.20	A2		1	U
5	83		11.66	1.38	1.19	G5	K0 III	1	U
5	84	-52 8856	11.85	0.58	0.35	B9	B9 III	1	
5	85		11.81	1.60	1.6	(M0)	K3 III	1	
5	86		11.36	1.25	1.10	G5	G8 III	1	U
5	87	-52 8857	10.29	0.84	0.44	K0		1	
5	88		12.76	0.58	0.00	F0		1	U
5	89		13.23	0.49	0.20	(B9)		1	
5	90	-51 8534	11.20	1.30	1.19	(K5)	K0 III	3	
5	91		12.75	0.46	0.16	A8		1	U
5	92		12.29	0.39	0.10	A7		1	
5	93	-51 8536	11.17	0.78	0.27	G0		1	
5	94		12.86	0.61	0.42	A5		1	U
5	95	-52 8859	11.78	0.32	0.28	B9		1	
5	96		12.53	0.60	-0.04	(B5)	B6 III	1	
5	97	-51 8537	12.05	0.56	0.06	F5		1	
5	98		12.29	1.45	1.7	(M0)	K2 III	1	
5	99		12.88	0.44	0.07	B9		1	U
5	100	-52 8860	11.94	0.30	0.12	B9		1	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
5	101	-52 8861	12.12	0.33	0.13	B9		1	
5	102	-51 8540	10.68	0.51	0.05	F5		1	
5	103		12.81	0.65	0.52	(A2)	A2 III	1	
5	104		12.78	0.59	0.18	(F2)		1	
5	105	140582	9.84	0.13	0.06	B9		2	
5	106	140582	11.51	0.36	0.06	(F0)		2	
5	107	-52 8865	10.88	0.48	0.04	F3		1	
5	108		12.83	0.72	0.49	(K0)	F0 III	3	
5	109		12.74	0.42	-0.02	(B7)		1	
5	110		12.52	0.31	0.22	A3		1	
5	111		12.33	0.63	0.65	A0	A1 III	1	
5	112	140605	7.06	-0.03	-0.47	B5		20	uvby,H,Str
5	113		12.01	0.55	0.01	F4		1	
5	114		12.61	1.58	2.2	(M5)	K3 III	1	
5	115		11.54	1.34	1.34	A0	A0 IA	1	
5	116		12.51	0.74	0.32	G2		1	U
5	117	-51 8544	12.22	0.44	0.04	(F2)		1	
5	118	140606	8.19	1.54	1.75	K0	K1 II	5	uvby,H
5	119	140620	8.86	-0.02	-0.46	B6		4	uvby,H
5	120	-51 8546	11.26	0.41	0.19	(A8)		1	
5	121		12.43	0.62	0.05	(G0)		1	
5	122		11.89	0.70	0.29	F5		1	
5	123	-52 8868	11.73	0.41	0.12	A2		1	
5	124	-51 8547	11.81	0.45	0.19	(A9)		1	
5	125	140621	8.37	0.38	-0.02	F0		4	uvby,H
5	126		12.56	0.42	0.24	A2		1	U
5	127	-51 8549	11.08	1.21	1.07	F2	F5 IB	1	Str
5	128		11.18	1.25	1.13	K0	K0 III	1	
5	129	140622	9.11	0.06	-0.06	B8-9		4	uvby,H
5	130		12.93	0.53	-0.06	(B5)		2	
5	131		11.17	1.22	0.97	G8	G8 III	1	
5	132		11.59	1.03	0.67	G8	G5 III	1	
5	133	-51 8552	10.83	0.59	0.12	F4		1	Str
5	134		12.75	0.58	0.27	(F0)		1	
5	135	-52 8872	10.40	1.09	0.82	G8	G8 III	1	
5	136	140678	9.62	0.42	0.08	A8		1	
5	137		12.64	0.50	0.14	F0		1	U
5	138		12.62	0.64	-0.06	F2		1	U
5	139		13.89	0.23	-0.26	(B6)		1	
5	140	-51 8555	11.61	0.47	0.15	F0		1	Str
5	141	-52 8878	10.54	0.33	0.17	A5		1	
5	142		12.57	0.49	0.12	F0		1	U
5	143		12.50	0.80	0.37	G0		1	U
5	144		12.49	0.53	0.06	(F5)		1	
5	145		12.12	0.57	0.17	F0		1	
5	146	-51 8561	12.14	0.41	0.21	B9		1	
5	147		12.48	1.07	0.77	(K1)	G5 III	1	
5	148	-51 8563	10.51	0.54	0.06	F0		3	
5	149		12.24	0.49	0.21	B8		1	
5	150	-51 8564	10.67	2.08	2.0	(K5)	K0 IB	2	

F	No	HD/CPD	V	B-V	U-B	Sp	Giant	N	Notes
5	151	-52 8883	11.77	0.44	0.20	B9		1	
5	152	-51 8566	10.78	0.13	-0.26	B6		2	Str
5	153	-52 8884	12.40	0.37	0.21	B9		1	
5	154		12.48	0.37	0.22	(A0)		2	
5	155	140741	9.94	-0.02	-0.31	B7		1	Str
5	156	-51 8570	11.15	0.26	0.20	A0		3	Str
5	157	-52 8885	9.66	1.40	1.50	K0	K2 III	1	
5	158	-51 8576	10.74	0.30	0.21	A0		1	Str
5	159	-52 8894	11.06	0.24	0.17	A2		1	
5	160	-51 8577	10.00	0.22	0.22	A0		3	Str
5	161	-52 8897	10.66	1.25	0.96	G8	K0 III	1	
5	162	-51 8580	11.15	0.49	0.31	A3		1	
5	163	-52 8902	10.46	1.31	1.41	G8	K0 III	1	
5	164	-52 8905	10.50	0.49	-0.09	B7	B7 III	1	
5	165	-51 8589	10.61	0.25	0.16	B9		1	
5	166	140979	6.03	1.39	1.45	K2	K3 III	1	uvby,H,O*
5	167	-51 8591	9.96	0.73	0.29	G8		1	
5	168	-51 8593	11.79	0.50	0.10	F3		1	
5	169	-51 8594	11.33	0.60	0.14	B8	B8 III	1	

Remarks on some of the stars

Field 1	no.	51	According to Smith (1968) this star is a WC7+BOV::.
		75	Possibly evolved, if member in Tr 18.
		87	May be an F-star, or a B-giant because of high reddening.
		97	May be an F-star, or a B-giant because of high reddening.
		133	Possibly evolved, if member in Tr 18.
		171	Possibly evolved, if member in Tr 18.
		173	Possibly evolved, if member in Tr 18.
		192	May be an F-star, or a B-giant because of high reddening.
		258	May be an F-star, or a B-giant because of high reddening.
		310	May be an F-star, or a B-giant because of high reddening.
		311	May be an F-star, or a B-giant because of high reddening.
		321	Probably a B2-star, if member in NGC 3590.
		322	Probably a B4-star, if member in NGC 3590.
Field 2	no.	11	Probably more luminous (earlier type or giant) because of high reddening.
		24	Probably more luminous (earlier type or giant) because of high reddening.
		153	May be an F-star, or a B-giant because of high reddening.
		154	Probably more luminous (earlier type or giant) because of high reddening.
		189	May be an F-star, or a B-giant because of high reddening.
Field 3	no.	1	=HD 106730. A fourth observation, in 1975, was rejected because it deviated much in V, although the colours were acceptable. Since this rejected V-value (=$8^m.48$) agrees with the one obtained by Klare and Neckel (1977) and the colours of all observations agree with their results and with Deutschman et al. (1976), while the latter obtained a still brighter V (=$8^m.35$) this star is possibly a variable.
		30	The large standard deviation in V indicates variability.
Field 4	no.	67	This star is extremely reddened, $E_{B-V}=1^m.60$, and may therefore be even more luminous than suggested here.
		92	The large standard deviation in V indicates variability.
		111	=HD 116781. $\beta=2.38$ indicates that emission occurs in Hβ, which has also been confirmed in the Michigan Catalogue (1975). The small standard deviation in V ($0^m.010$, even less in the colours) indicates stability, while the deviation ($0^m.17$) from the results by Klare and Neckel (1977) indicate variability. The colours agree, however.
		154	Probably more luminous (earlier type or giant) because of high reddening .
		158	The large standard deviation in V indicates variability
		181	May be an F-star, or a B-giant because of high reddening.
		186	The rather extreme reddening, $E_{B-V}=1^m.29$ may indicate a higher luminosity.
		204	The rather extreme reddening, $E_{B-V}=1^m.05$, may indicate a higher luminosity.
Field 5	no.	166	=HR 5865. A double star according to Bright Star Catalogue (1964) with magnitude difference =$4^m.6$ and a separation of 1".2.

The uvby, β Catalogue

The columns contain the following.

Column	1	Field number.
Column	2	Star number. This is identical with the corresponding number in the Main Catalogue and the finding charts.
Column	3	HD or CPD number (cf. Main Catalogue).
Column	4	The "V"-magnitudes as derived from Johnson system standards observed through the y-filter.
Column	5-8	Colours. Large standard deviation in the photometry is indicated by colon (:).
Column	9	Number of observations in uvby.
Column	10	Number of observations in β.
Column	11	Spectral type according to the Main Catalogue.

Field	No	HD/CPD	V	b-y	m_1	c_1	β	N uvby	N β	Sp
1	42	--	11.56	0.25	-0.01	0.24	2.62	3	2	B2
1	47	--	11.61	0.22	0.01	0.10	2.62	3	2	B0
1	50	306099	8.77	0.22	-0.06	-0.03	2.58	3	3	O8
1	51	97152	8.09	-0.72	1.66	-0.92	2.49	4	3	WC7
1	60	306096	9.32	0.25	-0.07	0.01	2.59	3	3	B0
1	65	306098	8.61	0.73	0.43	0.34	2.60	3	3	K1
1	66	-60°2588	10.51	0.25	-0.05	0.23	2.62	3	3	B2
1	82	97237	8.50	0.77	0.46	0.36	2.59	3	3	K0
1	88	97253	7.12	0.18	-0.02	-0.10	2.57	2	2	B0
1	144	306076	9.33	0.64	0.30	0.41	2.59	2	2	G2
1	171	306174	9.88	0.14	0.04	0.38	2.67	2	2	B4
1	173	-60°2619	9.11	0.14	0.03	0.41	2.64	2	2	B4
1	187	97381	8.31	0.11	0.01	0.07	2.61	3	4	B1
1	207	97400	7.80	0.14	0.01	0.19	2.59	3	4	B1
1	209	97399	8.46	0.11	-0.00	-0.03	2.61	3	4	B1
1	229	97434	8.09	0.21	-0.04	-0.09	2.57	2	2	O5
1	253	306180	10.32	0.28	-0.04	0.11	2.62	2	3	B0
1	267	-60°2647	10.37	0.20	-0.02	0.06	--	1	0	B2
1	271	306183	10.16	0.09	0.12	1.10	2.87	2	3	B9
1	283	306179	10.43	0.22	-0.03	0.04	2.66	2	3	B0
1	341	97707	8.11	0.44	-0.07	0.07	2.56	2	2	B0
2	19	100098	8.55	0.21	0.06	1.39	2.84	2	2	B8
2	35	100163	9.93	0.20	0.06	1.05	2.89	2	2	B8-9
2	115	100444	8.43	0.23	-0.03	-0.10	2.58	2	2	B0
2	190	100791	8.76	0.95	0.65	0.41	2.58	1	1	K4
2	197	308711	9.19	0.92	0.62	0.44	2.57	1	1	K5
3	27	106984	8.15	1.09	0.61	0.36	2.59	2	2	K3
3	33	107050	9.27	0.23	0.13	0.93	2.84	2	2	A0
3	62	107223	8.21	0.07	0.11	1.08	2.90	2	2	B9
3	70	107270	7.15	0.70	0.33	0.37	2.60	2	2	G5
3	89	107357	7.99	0.60	0.28	0.44	2.60	2	2	G5
3	99	-63°2248	9.98	0.35	0.11	0.60	2.70	2	2	F5
3	137	107592	7.54	0.82	0.48	0.46	2.61	2	2	K0
3	146	107720	7.13	0.69	0.47	0.44	2.59	2	2	K0
4	21	116374	9.00	0.19	0.02	1.24	2.81	2	2	B8-9
4	67	-61°3692	9.72	1.09	-0.30	0.22	2.58	5	5	O9
4	92	--	11.05	2.16:	-0.42:	0.43:	2.70:	4	4	M5
4	95	116734	8.40	0.31	0.15	0.52	2.69	2	2	F5
4	111	116781	7.61	0.17	-0.04	-0.23	2.38	2	2	O8
4	157	--	10.68	1.11	0.11	0.09:	2.61	3	3	G5
4	183	117000	6.65	0.81	-0.11	1.12	2.67	2	2	F8
5	41	140354	8.34	1.20	0.65	0.37	2.64	1	1	K5
5	74	140447	8.18	0.09	0.08	1.14	2.79	1	1	B9
5	112	140605	7.08	0.01	0.08	0.48	2.69	3	3	B5
5	118	140606	8.20	0.97	0.67	0.45	2.58	2	2	K0
5	119	140620	8.87	0.02	0.08	0.49	2.71	2	2	B6
5	125	140621	8.37	0.25	0.15	0.55	2.74	2	2	F0
5	129	140622	9.11	0.07	0.09	0.94	2.87	2	2	B8-9
5	166	140979	6.05	0.87	0.57	0.40	2.58	1	1	K2

HD	CPD	Field	No
97152	-60°2378	1	51
97223	-59 3113	1	75
97237	-60 2593	1	82
97253	-59 3116	1	88
97284	-60 2598	1	113
97381	-59 3156	1	187
97399	3166	1	209
97400	3164	1	207
97434	-60 2629	1	229
97581	2665	1	300
97707	2698	1	341
100098	-62 2062	2	19
100162	2071	2	34
100163	2072	2	35
100200	2077	2	45
100243	2080	2	53
100263	2081	2	61
100295	2084	2	68
100444	2094	2	115
100495	2096	2	124
100791	2121	2	190
106730	-63 2219	3	1
106781	-64 1843	3	5
106796	1845	3	6
106874	1850	3	16
106984	1854	3	27
107050	-63 2239	3	33
107111	-64 1858	3	38
107154	1862	3	51
107190	-63 2243	3	56
107223	-64 1865	3	62
107269	-63 2244	3	67
107270	2246	3	70
107300	-64 1867	3	76
107338	1871	3	88
107357	1872	3	89
107527	1876	3	125
107565	1877	3	128
107581	1878	3	133
107592	-63 2251	3	137
107720	-64 1886	3	146
107790	1889	3	156
107945	1895	3	170
116313	-61 3058	4	8
116314	3059	4	9
116374	3069	4	21
116456	3078	4	33
116589	3086	4	50
116607	3088	4	53
116734	-62 3264	4	95
116781	-62°3270	4	111
116795	-61 3704	4	114
116826	3709	4	132
116827	3706	4	125
116841	3710	4	137
116888	3721	4	162
116951	3729	4	179
117000	3732	4	183
117059	3735	4	191
117134	3741	4	202
117185	3745	4	205
117195	3746	4	206
117196	3747	4	208
140221	-51 8497	5	13
140222	8495	5	12
140288	8507	5	26
140289	-52 8816	5	25
140354	8827	5	41
140447	8847	5	74
140582	8866	5	105,106
140605	-51 8542	5	112
140606	8543	5	118
140620	8545	5	119
140621	8548	5	125
140622	8550	5	129
140678	-52 8874	5	136
140741	-51 8569	5	155
140979	-52 8912	5	166
306054	-59 3103	1	61
306055		1	54
306056	3106	1	70
306057	3126	1	122
306058	3127	1	123
306059	3099	1	37
306070	3095	1	25
306071	3093	1	15,16
306072	3096	1	30
306073	3098	1	36
306074	3105	1	69
306075	3132	1	133
306076	3138	1	144
306077	-60 2595	1	95
306078	2608	1	138
306079		1	101
306080	2590	1	73
306081	2585	1	63
306082	2574	1	45
306083	2579	1	55
306084	2573	1	44
306085	2566	1	11

HD	CPD	Field	No
306086	-59°3090	1	7
306095	-60 2580	1	56
306096	2582	1	60
306097	2613	1	155
306098	2587	1	65
306099	2577	1	50
306166	-59 3196	1	305
306167	3210	1	333
306171	3204	1	325
306172	3170	1	232
306173	3137	1	142,143
306174	3151	1	171
306175		1	184
306176		1	203
306177	-60 2627	1	221
306178	-59 3189	1	284,286
306179	-60 2652	1	283
306180	2640	1	253
306181	2623	1	212
306182		1	190
306183	2648	1	271
306184	2658	1	293,294
306185	2674	1	316
306186	2676	1	321
306187	2657	1	291
306188	2625	1	219
306189	2622	1	206
308583	-62 2073	2	38
308588	2059	2	16
308589	2074	2	40
308590		2	27
308591	2058	2	15
308592	2050	2	7
308593	2046	2	4
308594	2044	2	2
308595	2064	2	21
308596	2068	2	31
308597	2067	2	30
308598	2070	2	32
308599		2	51
308600		2	59
308601	2085	2	73
308602		2	113
308603		2	116
308604	2093	2	107
308605		2	71
308606	2082	2	64
308607	2091	2	103
308608		2	75
308609	2055	2	12
308610	-62°2052	2	11
308611		2	26
308613		2	56
308679	2108	2	155
308680	2092	2	104
308681		2	136
308682	2113	2	166
308683	2117	2	175
308687	2110	2	184
308693	2123	2	192
308694		2	176
308695	2118	2	177
308696	2114	2	167
308697		2	162
308698	2112	2	163
308699	2109	2	156
308700		2	146
308701		2	141
308702	2097	2	132
308703	2099	2	137
308704	2101	2	139
308705		2	149
308706		2	160
308707	2098	2	135
308708		2	178
308709		2	185
308710		2	195
308711	2128	2	197

CPD	HD	Field	No
-51°8468		5	3
8491		5	7
8493		5	8
8494		5	9
8495	140222	5	12
8497	140221	5	13
8499		5	15
8501		5	21
8502		5	22
8503		5	23
8506		5	24
8507	140288	5	26
8508		5	27
8509		5	28
8510		5	31
8515		5	45
8518		5	46
8522		5	59
8525		5	69
8527		5	72
8528		5	76
8533		5	81
8534		5	90
8536		5	93
8537		5	97
8540		5	102
8542	140605	5	112
8543	140606	5	118
8544		5	117
8545	140620	5	119
8546		5	120
8547		5	124
8548	140621	5	125
8549		5	127
8550	140622	5	129
8552		5	133
8555		5	140
8561		5	146
8563		5	148
8564		5	150
8566		5	152
8569	140741	5	155
8570		5	156
8576		5	158
8577		5	160
8580		5	162
8589		5	165
8591		5	167
8593		5	168
8594		5	169

CPD	HD	Field	No
-52°8782		5	1
8783		5	2
8789		5	4
8790		5	5
8792		5	6
8799		5	11
8801		5	10
8807		5	16
8809		5	18
8812		5	19
8814		5	20
8816	140289	5	25
8819		5	29
8822		5	33
8823		5	37
8827	140354	5	41
8833		5	49
8835		5	52
8836		5	56
8839		5	57
8840		5	58
8841		5	62
8844		5	66
8845		5	68
8846		5	71
8847	140447	5	74
8851		5	79
8856		5	84
8857		5	87
8859		5	95
8860		5	100
8861		5	101
8865		5	107
8866	140582	5	105,106
8868		5	123
8872		5	135
8874	140678	5	136
8878		5	141
8883		5	151
8884		5	153
8885		5	157
8894		5	159
8897		5	161
8902		5	163
8905		5	164
8912	140979	5	166
-59°3090	306086	1	7
3093	306071	1	15,16
3095	306070	1	25
3096	306072	1	30

CPD	HD	Field	No
-59°3098	306073	1	36
3099	306059	1	37
3103	306054	1	61
3105	306074	1	69
3106	306056	1	70
3113	97223	1	75
3116	97253	1	88
3120		1	98
3121		1	112
3126	306057	1	122
3127	306058	1	123
3130		1	128
3132	306075	1	133
3133		1	137
3135		1	140
3136		1	141
3137	306173	1	142,143
3138	306076	1	144
3139		1	148
3141		1	149
3143		1	156
3145		1	161
3146		1	162
3148		1	167
3149		1	168
3150		1	170
3151	306174	1	171
3154		1	185
3155		1	186
3156	97381	1	187
3159		1	196
3161		1	197
3162		1	199,200
3163		1	201
3164	97400	1	207
3166	97399	1	209
3167		1	216
3168		1	217
3169		1	226
3170	306172	1	232
3173		1	236
3174		1	237
3179		1	225
3181		1	257
3182		1	273
3183		1	274
3184		1	276
3185		1	277
3186		1	278,279
3187		1	281

CPD	HD	Field	No
-59°3189	306178	1	284,286
3192		1	299
3196	306166	1	305
3203		1	317
3204	306171	1	325
3210	306167	1	333
-60°2566	306085	1	11
2573	306084	1	44
2574	306082	1	45
2577	306099	1	50
2578	97152	1	51
2579	306083	1	55
2580	306095	1	56
2582	306096	1	60
2584		1	62
2585	306081	1	63
2587	306098	1	65
2588		1	66
2589		1	68
2590	306080	1	73
2593	97237	1	82
2595	306077	1	95
2596		1	96
2598	97284	1	113
2603		1	126
2604		1	127
2607		1	132
2608	306078	1	138
2609		1	145
2611		1	146
2612		1	154
2613	306097	1	155
2617		1	159
2619		1	173
2622	306189	1	206
2623	306181	1	212
2625	306188	1	219
2627	306177	1	221
2629	97434	1	229
2633		1	241
2636		1	250
2640	306180	1	253
2646		1	266
2647		1	267
2648	306183	1	271
2652	306179	1	283
2655		1	287
2656		1	288
2657	306187	1	291
2658	306184	1	293,294

CPD	HD	Field	No
-60°2665	97581	1	300
2666		1	303
2667		1	304
2669		1	309
2670		1	310,311
2671		1	312
2673		1	315
2674	306185	1	316
2676	306186	1	321
2680		1	327
2686		1	333
2692		1	336
2698	97707	1	341
-61°3652		4	1
3653		4	2
3656		4	5
3657		4	7
3658	116313	4	8
3659	116314	4	9
3660		4	10
3661		4	11
3664		4	14
3666		4	16
3667		4	17
3668		4	19
3669	116374	4	21
3670		4	23
3671		4	24
3672		4	26
3673		4	27
3674		4	28
3675		4	30
3677		4	31
3678	116456	4	33
3679		4	34
3681		4	37
3683		4	38
3684		4	41
3685		4	44
3686	116589	4	50
3687		4	51
3688	116607	4	53
3689		4	55
3690		4	57
3691		4	58
3692		4	67
3693		4	70
3694		4	73
3695		4	75
3696		4	76

CPD	HD	Field	No
-61°3697		4	83
3698		4	84
3699		4	89
3700		4	94
3701		4	102
3702		4	112
3703		4	113
3704	116795	4	114
3705		4	121
3706	116827	4	125
3707		4	126
3708		4	127
3709	116826	4	132
3710	116841	4	137
3711		4	140
3712		4	148
3713		4	149
3714		4	150
3715		4	151
3716		4	154
3718		4	155
3721	116888	4	162
3725		4	167
3726		4	168
3727		4	172
3728		4	175
3729	116951	4	179
3730		4	180
3732	117000	4	183
3733		4	184
3734		4	188
3735	117059	4	191
3736		4	193
3737		4	196
3741	117134	4	202
3742		4	204
3745	117185	4	205
3746	117195	4	206
3747	117196	4	208
3749		4	209
-62°2044	308594	2	2
2046	308593	2	4
2050	308592	2	7
2052	308610	2	11
2055	308609	2	12
2058	308591	2	15
2059	308588	2	16
2062	100098	2	19
2064	308595	2	21
2067	308597	2	30

CPD	HD	Field	No
-62°2068	308596	2	31
2070	308598	2	32
2071	100162	2	34
2072	100163	2	35
2073	308583	2	38
2074	308589	2	40
2077	100200	2	45
2080	100243	2	53
2081	100263	2	61
2082	308606	2	64
2084	100295	2	68
2085	308601	2	73
2091	308607	2	103
2092	308680	2	104
2093	308604	2	107
2094	100444	2	115
2096	100495	2	124
2097	308702	2	132
2098	308707	2	135
2099	308703	2	137
2101	308704	2	139
2108	308679	2	155
2109	308699	2	156
2112	308698	2	163
2113	308682	2	166
2114	308696	2	167
2117	308683	2	175
2118	308695	2	177
2120	308687	2	184
2121	100791	2	190
2123	308693	2	192
2124		2	193
2125		2	194
2128	308711	2	197
3260		4	80
3265	116734	4	95
3270	116781	4	111
-63°2219	106730	3	1
2227		3	4
2232		3	18
2239	107050	3	33
2243	107190	3	56
2244	107269	3	67
2246	107270	3	70
2247		3	85
2248		3	99
2250		3	135
2251	107592	3	137
2252		3	141
2253		3	142
-63°2256		3	153
2257		3	155
2262		3	166
-64°1840		3	3
1843	106781	3	5
1845	106796	3	6
1846		3	8
1849		3	12
1850	106874	3	16
1854	106984	3	27
1855		3	28
1858	107111	3	38
1859		3	45
1860		3	49
1861		3	50
1862	107154	3	51
1863		3	52
1864		3	61
1865	107223	3	62
1867	107300	3	76
1871	107338	3	88
1872	107357	3	89
1873		3	116
1874		3	118
1876	107527	3	125
1877	107565	3	128
1878	107581	3	133
1880		3	136
1884		3	143
1885		3	144
1886	107720	3	146
1887		3	147
1889	107790	3	156
1890		3	157
1891		3	160
1893		3	167
1895	107945	3	170

10'

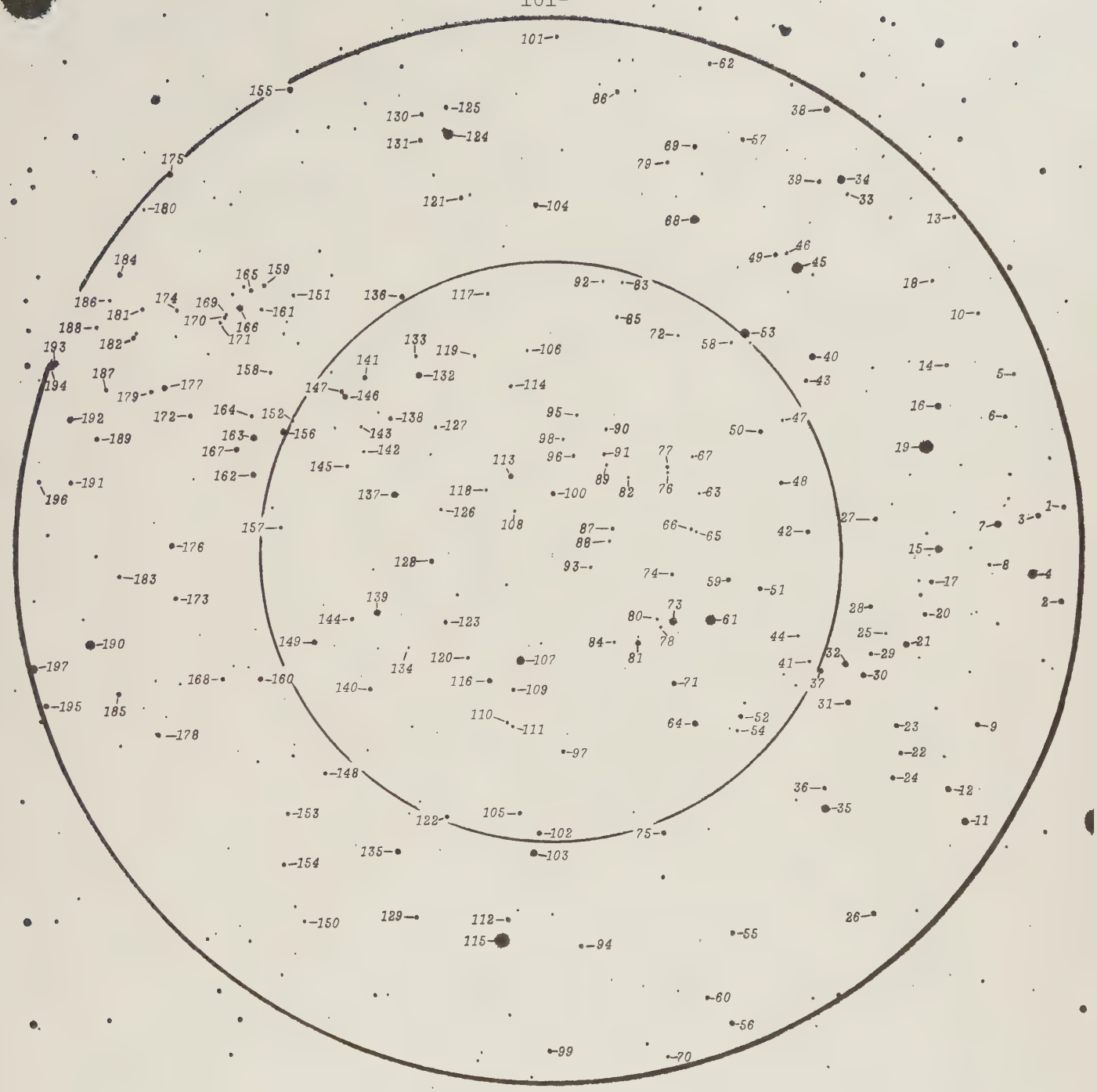
E

S

FIELD 1 Coordinates of centre (1950)

R.A. $11^h\ 09^m.2$

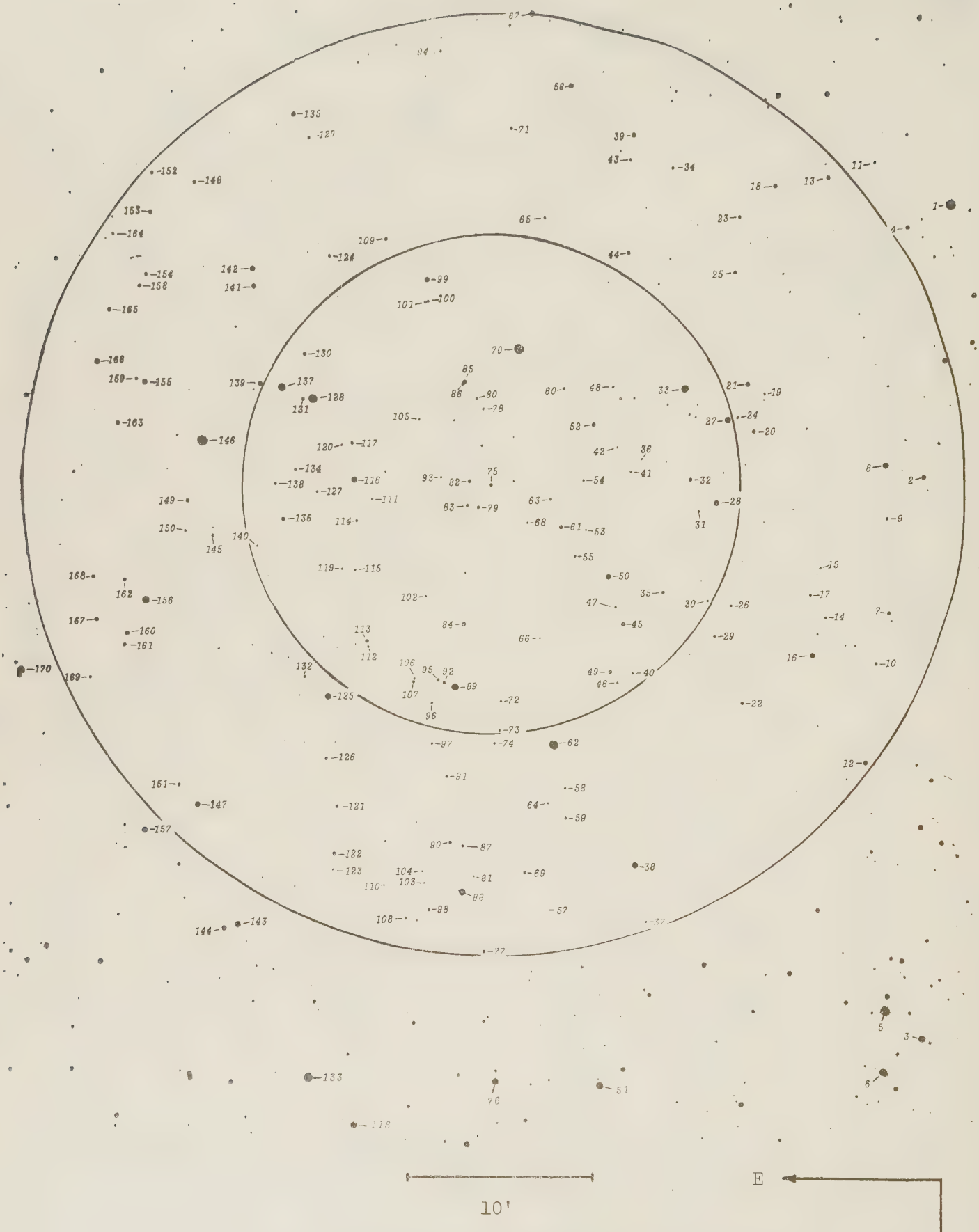
Decl. $-60^\circ\ 23'$



FIELD 2 Coordinates of centre (1950)

R.A. $11^{h}\ 30^{m}.3$

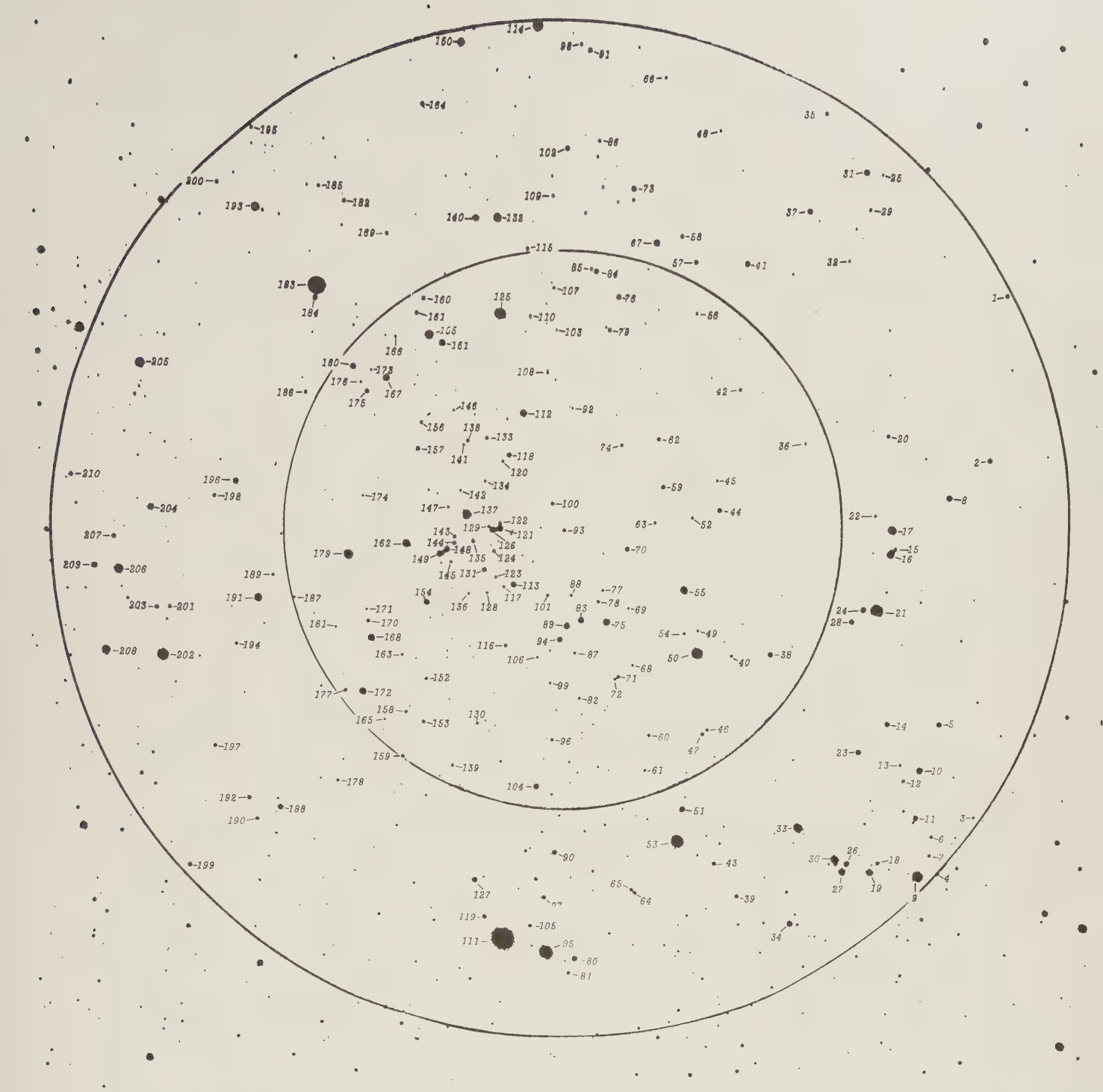
Decl. $-\ 63^{\circ}\ 06'$



FIELD 3 Coordinates of centre (1950)

R.A. $12^h\ 17^m.8$

Decl. $-\ 64^\circ\ 30'$



10'

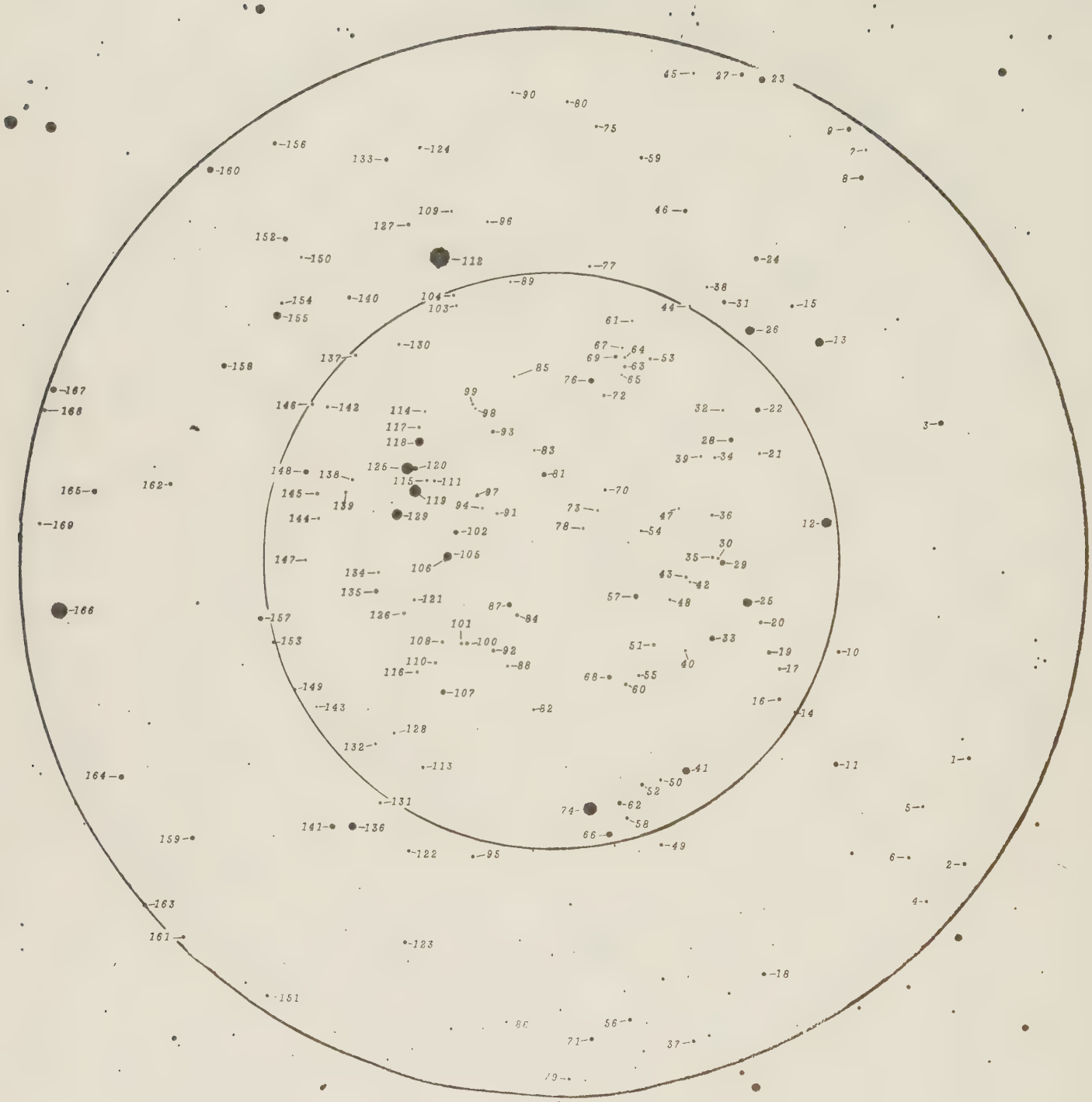
E

S

FIELD 4 Coordinates of centre (1950)

R.A. $13^h\ 23^m.8$

Decl. $-\ 62^\circ\ 03'$



10'

E

S

FIELD 5 Coordinates of centre (1950)

R.A. $15^h\ 42.^m4$

Decl. $-\ 52^\circ\ 15'$

Appendix A.

A simple programme generating fictitious stars at random positions

To make a "random" distribution of fictitious stars, one needs to know

a) the luminosity function,
b) the distribution of absolute magnitude within each luminosity group,
c) the colour excess and its relation to the extinction,
d) the magnitude of completeness,
e) the volume observed.

The fictitious stars were distributed within a box having a length corresponding to an extinction-corrected distance modulus $B_L - M_B + 0^m.5$ (being $13^m.5$ at the most). The addition of $0^m.5$ was made to allow for the dispersion in M_B (cf. point b above). B_L is the limiting magnitude of the actual field region. The base area of the box was kept constant at $4R^2$, with $R = D \tan\phi$ ($D = 5012$ pc, corresponding to $B_o - M_B = 13^m.5$, and ϕ = the angular radius of the actual field region). The length of the box, however, was allowed to shrink for fainter luminosity groups, as in them stars beyond $B_L - M_B + 0^m.5$ would never be observed.

From the luminosity function used, and the volume of the actual box, the expected numbers of stars of the various luminosity groups were calculated. The corresponding numbers of fictitious stars were allotted random positions in the box, and random absolute magnitudes within the actual luminosity group (within $\pm 0^m.5$) by means of a random function having a rectangular distribution. This random function uses the following algorithm:

$$X_{i+1} = A\, X_i \pmod p \quad , \quad A = 16\,807 \quad \text{and} \quad p = 2^{31} - 1$$

and was available at UDAC in Uppsala during the calculations.

Those fictitious stars that had $B_o - M_B < 13^m.0$ and fell within the space cone were accepted in the first step. Then their apparent B-magnitudes were calculated from the equation (3) using the known distances and absolute magnitudes, assuming $A_B = 4.2 E_{B-V}$, where we used the mean colour excess of all fields together:

$$E_{B-V} = 0 \qquad r < 150 \text{ pc}$$
$$E_{B-V} = 0^m.11 + 0^m.26 \times 10^{-3}\, r \qquad 150 \text{ pc} < r < 1100 \text{ pc}$$
$$E_{B-V} = 0^m.40 \qquad r > 1100 \text{ pc}$$

If the resulting B-magnitudes were fainter than the limiting magnitude of the actual field region, they were rejected, otherwise they were accepted. A simple scheme of the procedure is given in Figure 28. The limiting magnitudes and angular diameters used are given in Table 1, while the luminosity groups used are given in Table 19. The luminosity functions used are given in Table 17 (chapter 4).

Table 19. The luminosity groups used in the study of the stellar distribution (Schmidt-Kaler 1965).

$M_B \pm 0^m.5$	V	III	II	Ib	Ia
-6	O5-O7	O9-O9.5	O9-B0	O9-B9	O9-B5,K3-K5
-5	O8-B0	B0-B1	B1-B5	A0-F1	M0-M5
-4	B0.5-B1	B2	B7	F2-G5	
-3	B2	B3-B4	A1-A5	G6-M5	
-2	B3-B4	B5-B7	A6-F9		
-1	B5-B7	B8-B9	G0-M5		
0	B8-B9	A0-A1			
1	A0-A1	A2-A7,M0-M5			
2	A2-A6	A8-G7,K0-K9			
3	A7-F2	G8-G9			
4	F3-F7				
5	F8-G2				
6	G3-G9				
7	K0-K2				

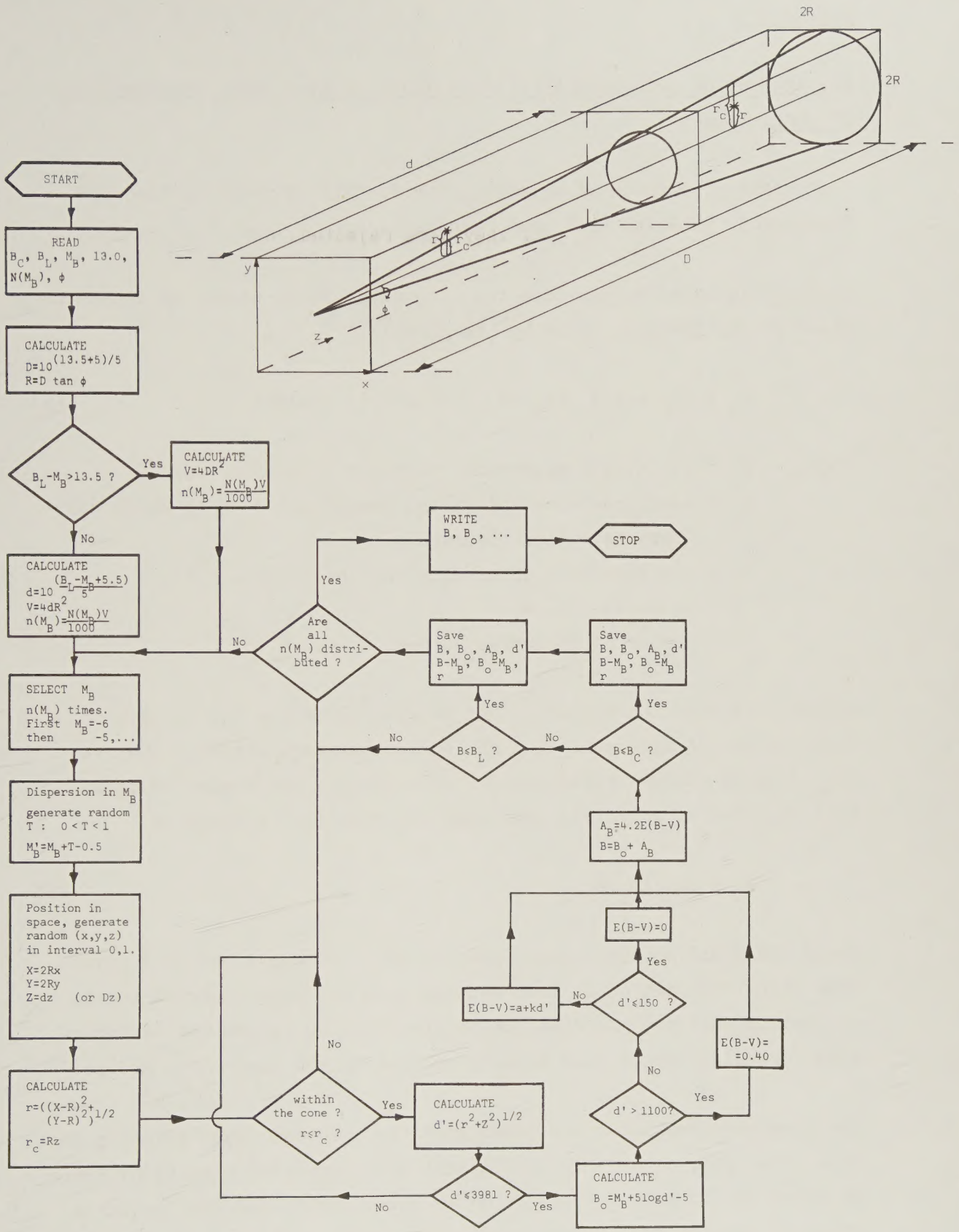


Fig. 28. The procedure of distributing fictitious stars in a random way. ($N(M_B)$ is the number of stars per 1000 pc^3 of a certain M_B.)

Appendix B

The methods of selecting fictitious stars fainter than the magnitude of completeness

Two different methods of selecting the fictitious stars in the apparent B-magnitude interval B_C-B_L has been used.

Method 1 is based on the idea that among the faint stars, we should have observed the fraction given by the formula

$$h_i = (B_L - B_C)^{-1}(B_L - B_C - dB/2 - (i - 1)dB) \qquad (4)$$

where B_L = limiting B-magnitude (faintest star observed),
B_C = magnitude of completeness (magnitude down to which all stars have been observed),
dB = the magnitude interval used (in our case $0^m.2$),
i = 1, 2, 3, ..., N
N = number of intervals between B_L and B_C .

Method 2 is based on method 1, but we also normalize the numbers in order to obtain agreement with the number of stars actually observed (N_{obs}) in the actual field region. Accordingly, the number of stars (N_i) expected at a certain magnitude interval (i) is given by

$$N_i = (h_i/\Sigma h_i)N_{obs} \qquad (5)$$

Using the modified luminosity function (cf. Table 17) method 1 gives more stars than method 2. Both methods give too many stars in total, suggesting that the modified luminosity function is somewhat exaggerated regarding the stellar density of some of the luminosity groups.

The observed frequences are based upon the spectral types given in the Main Catalogue, column 'Sp' or 'Giant' (for suspected giants) by means of Table 19. In this investigation we have disregarded the few stars observed outside the circular regions (cf. the finding charts).